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NORTHAMPTONSHIRE COUNTY COUNCIL

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Annual Report

OF THE

MEDICAL OFFICER OF HEALTH

FOR THE YEAR

1934

Survey of Water Supplies

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Survey of Water Supplies

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Rushden:
Stanley L. Hunt, The Printeries,
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Quotations in the text are taken, in order of sequence, from Morton's Northamptonshire, Camden's Britannia, and the Victoria History of Northampton. All references to the history of individual water supplies have appeared in the public press—no private documents have been used.

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NORTHAMPTONSHIRE COUNTY COUNCIL.

County Health Department,
Guildhall Road,
Northampton.

January, 1935.

To the Chairman and members of the Northamptonshire County Council.

Mr. Chairman, My Lords, Miss Cartwright, and Gentlemen,

I have the honour to submit, as the first part of the Annual Report for the year 1934, a summary of my survey of the water resources of Northamptonshire. The actual survey, which is largely in tabular form, will be completed during 1935 and retained for reference.

The purpose of this summary is to present in a readable form the main findings of the survey, and to draw from them any conclusions which may assist the Authorities in framing a policy for the future. The report takes no account of emergency remedies for water shortage ; it seeks a permanent solution for the problem.

In presenting my report I acknowledge, with sincere thanks, the splendid assistance which I have received from the Clerks of District Councils, and the Surveyors and Sanitary Inspectors. I also wish to thank Messrs. Pick, Everard, Keay and Gimson, the Council's Consulting Engineers, and many private individuals who gave me the benefit of their knowledge of local conditions. A special debt of gratitude is due to the many Women's Institutes who contributed both technical and human documents to the survey.

I have the honour to be,

Your obedient Servant,

J. M. MACKINTOSH.
County Medical Officer of Health.

PART I.

INTRODUCTION.

A. PHYSICAL FEATURES.

This report is an effort to give some account of the water supplies of Northamptonshire. The general description of the physical features and geology of the County is intended merely to form a background to the main subject, and no attempt has been made to deal with matter which is not strictly relevant to an understanding of our water resources.

The annals of Northamptonshire are well stocked with accurate and detailed studies of the history of the County and its people, and its geology and physical features have been elaborately worked out by Beeby Thompson and others, to whose publications reference should be made.

Northamptonshire is an elongated county with its main axis running from south-west to north-east ; its shape has been aptly likened to a laurel leaf with its midrib represented by the River Nene. The greatest length is approximately sixty-seven miles, and the greatest width at right angles to the axis is twenty-four miles.

The most important feature from the point of view of water supplies, is a ridge of high ground known as the Northamptonshire Uplands, which borders the western and north-western part of the County.

Although these hills reach no great height, they form the fulcrum of the watershed of central England. From their western slopes the Avon and the Leam flow into the Severn Basin ; the Cherwell runs south to join the Thames ; and on the east the Great Ouse, the Nene and the Welland, wind slowly to the Wash and the North Sea ; " and hence arises that observation of Northamptonshire that her supplies of water are all from within herself, that she imparts to many counties and receives water from none." Many rivers rise within the County, but the Nene alone passes " in a manner through the midst of this province to which it is a continual blessing."

An extension of the western uplands branches at right angles to the north-east and runs close to the northern border of the County until it gradually descends into the Lincolnshire plain. The remainder of the County is generally undulating with a gradual fall towards the east until it finally merges into fenland.

Rivers and Streams

Our first consideration in examining the water resources of the County would naturally be a study of the existing rivers and streams to determine the possibilities of storing their supplies. The River Nene has two main branches which join at Northampton ; the western head takes its origin in a valley between Staverton and Badby and flows east past Newnham, Weedon and Kislingbury to Northampton. Throughout this part of its course there is no suitable area for reservoir construction as the valley spreads out without any natural barrier and there are several villages at a comparatively low level ; in any case the small volume of the stream would not justify a large expenditure on water storage. The most important tributary is the Nenmoor stream which joins the main channel just east of Weedon. This tributary may, as will be shown later, form an important source of local water supply, but is quite unsuitable for a large scheme.

The northern head of the Nene rises in Naseby parish and flows in a southerly direction between Brixworth and Spratton to join the main water at Northampton. It receives a number of tributaries from both sides, the most important of which are the Stowe brook, which runs east of Guilsborough through Hollowell ; the Coton or Ravensthorpe brook which is the main feeder of the Ravensthorpe Reservoir ; and the Brampton brook which runs between Church Brampton and Harlestone. The principal tributaries on the east are the Walgrave and Moulton brooks. The only part of this basin which appears to be suitable for water storage is the Stowe brook which runs through a somewhat deep valley as far as Hollowell, and the Northampton Corporation have already certain rights to conserve the water in this area. The Ravensthorpe Reservoir has a relatively small catchment basin, but is conveniently situated as regards height for supplying part of Northampton by gravitation.

Between Northampton and Oundle the Nene cannot be used for the storage of water except by the natural means of its valley gravels. It will be sufficient for the present to indicate that the Nene, and to a lesser degree the Welland and other rivers of Northamptonshire do not possess the physical formation suitable for the construction of reservoirs.

On the other hand, the extensive river gravels and mid-glacial deposits store an immense quantity of water and form a natural reservoir which has been successfully utilized at Irthlingborough, Raunds, Woodford, Oundle and elsewhere.

From Wellingborough to Wansford, where the River Nene finally leaves the County, the river receives three important tributaries on its west bank ; the first and largest of these, the Ise Brook, rises between Clipston and Naseby and runs in an easterly direction past Arthingworth and Desborough. It passes through a small lake at Rushton, and at Geddington turns sharply south to the eastern border of Kettering where it feeds the Wicksteed Park Lake. Thence its southerly course is continued between Isham and Burton Latimer to the south-east of Wellingborough where it joins the Nene. The Valley of the Ise is wide and its slope is gentle, and there is no part of its course in which a satisfactory permanent reservoir could be constructed. An important tributary, the Slade brook, enters the Ise at Kettering just below Wicksteed Park Lake. The main stream of this brook passes close to the town of Rothwell and skirts the western and southern boundaries of Kettering. Two of its tributaries from the south are feeders of the Thorpe and Cransley Reservoirs of the Kettering Urban District. Their catchment area, however, is very small, and there is no real possibility of obtaining a large supply of water from these sources.

Harper's Brook rises west of Pipewell and runs eastward parallel to the River Ise through the Oakleys to Stanion ; thereafter it turns gradually south-east and joins the Nene between Thrapston and Aldwincle. This brook has little significance apart from local water supplies.

Further north the longer and more important Willow Brook rises a short distance west of Corby and runs at first in a north-easterly direction through Corby, Great Weldon and Deene ; at Deene it contributes to the formation of a lake which has recently been dredged to provide an additional water supply for the Steel Works at Corby ; still flowing north-east, the Willow Brook forms a lake of considerable size at Blatherwycke—which has also been dredged to augment the water supply of the Steel Works. On leaving Blatherwycke Lake, the stream turns east through Kings Cliffe and forms a small ornamental lake at Apethorpe ; it finally joins the Nene on the County Boundary at Elton. This stream, as we have seen, has been employed in the formation of several shallow artificial lakes, but its course and the general formation of its banks will not permit the construction of a reservoir of any considerable dimensions.

In short, the only tolerably good sites for reservoir construction in the basin of the River Nene are the tributaries of its northern headwaters in the somewhat deep valleys lying between the Northampton—Welford Road and the Northampton—Rugby Road as far as West Haddon.

The Welland.

The River Welland can hardly be described as a Northamptonshire stream, as it forms the northern boundary of the County almost the whole way from Welford to Stamford. It rises within the County near Sibbertoft, and almost immediately begins to form the boundary while it is yet hardly distinguishable as a stream. Like the Nene, it has a narrow drainage area and receives very few tributaries from Northamptonshire on account of the steep slope of its southern borders. For various reasons there is no part of its course suitably formed for reservoir construction. On its left bank, however, where the slopes are more gentle, it receives a vigorous tributary known as the Eye Brook, which rises near Tilton in Leicestershire, and forms the boundary between Leicestershire and Rutland for a considerable distance. It enters the Welland about a mile north-east of Rockingham Bridge. The main interest of this stream is that it flows through a somewhat narrow valley with steep sides throughout its course, and especially from Allexton to Stoke Dry. A scheme, which will be referred to later, has been brought forward for the construction of a reservoir of a sufficient size to serve a very large part of Northamptonshire.

The River Avon.

The Warwickshire Avon rises in the village of Naseby and flows in a north-westerly direction to Welford, where it forms the County Boundary. Two miles beyond Welford it turns west and continues to form the boundary until it leaves the County at Dow Bridge on Watling Street. The headwaters of this stream serve the Naseby Reservoir of the Grand Union Canal Company, hardly a mile from the source at Naseby. Close to Welford a small tributary of the main stream feeds the canal reservoir at Sulby. Between Downtown Hill and South Kilworth the main stream of the Avon is expanded to form a reservoir of considerable size which supplies water to the town of Rugby. Apart from the reservoirs already constructed, there is no possibility of storing the waters of this stream to provide for the needs of Northamptonshire.

The River Leam.

The River Leam, which is a tributary of the Avon, rises in Northamptonshire from some springs which form a pool close to the village of Helidon. Its headwaters are derived from the middle lias which outcrops extensively in this area. It then runs in a north-north-westerly direction through quite a deep gorge and begins to form the County Boundary where it passes under the Daventry—Southam Road one mile west of Staverton. It leaves the County and passes wholly into Warwickshire just west of Braunston. The Leam receives a number of tributaries from the Northamptonshire or eastern side, but their low level relative to the Northampton heights render them unsuitable for water supplies to this County. Staverton, for example, stands at 560 feet, and the Leam at its nearest point is only 358 feet. Moreover, the marlstone sources of the Leam tributaries are unreliable on account of the sharp slope of the escarpment.

The River Cherwell.

The River Cherwell rises close to the village of Charwelton and flows in a southerly direction. It is fed by a number of small Northamptonshire streams, none of which has more than a local importance. The main stream runs between Woodford Halse and Hinton, and turns westward through the grounds of Edgcote Park, leaving the County between Chipping Warden and Wardington. Its course thence, through Cropredy southwards to Banbury, is almost entirely in Oxfordshire ; a short distance north of Banbury it is a boundary stream, and afterwards, about one mile south of Banbury, it again separates Oxfordshire from Northamptonshire as far as the extreme south-west between Aynho and Clifton. None of the lower tributaries has more than a local importance as regards water supply, although the streams rising at Chacombe and Greatworth are of considerable length.

The Great Ouse.

The Great Ouse can hardly be considered as a Northamptonshire stream ; it rises close to Greatworth village and runs in a southerly direction to Brackley, where it forms part of the County Boundary for a short distance before entering Buckinghamshire. An important tributary, also known as the Ouse, rises near Wappenham and flows in a south-westerly direction through Syresham and forms the County Boundary up to the point where it joins the main stream south-east of Brackley. This stream forms a large drainage area for the south-west of the County, but has no value from the point of view of general water supply. The Great Ouse then flows eastwards through the town of Buckingham, and once again becomes a boundary stream at Thornton Hall, south of Wicken, and retains this position until its junction with the Tove. By far the greatest tributary of the Ouse is the River Tove, which rises near Sulgrave and drains a large part of the Towcester and Potterspury Districts. After passing through

Towcester, it reaches the County Boundary at Bozenham Mill near Ashton, in the Potterspury Rural District, and separates Northamptonshire from Buckinghamshire until its junction with the Great Ouse just north of Wolverton. The Tove flows eastwards from its source and is fed by a large number of streams in the Towcester District ; its most important tributary comes from Preston Capes through Maidford and Blakesley. The general course of the Tove and its tributaries is not suitable for the collection of water by means of reservoirs. Its flow is sluggish, and it can be used, at best, only for the drainage of the villages which lie on its course.

Reservoirs.

A considerable number of reservoirs and artificial lakes already exist in Northamptonshire, but only three of them are actually in use to provide domestic water supplies for the Administrative County. The most important of these is the Sywell Reservoir belonging to the Rushden and Higham Ferrers Water Board ; it is situated between Ecton and Mears Ashby, and is fed by ironstone springs and two small streams from Hardwick district which run south to join the Nene between Ecton and Earls Barton. The two remaining members of this class are the Cransley and Thorpe Malsor Reservoirs belonging to Kettering Urban District, which are fed by ironstone springs and partly by headwaters of the Slade Brook which joins the River Ise. In addition, the County Borough of Northampton owns a reservoir at Ravensthorpe which is fed by small tributaries of the north Nene, supplemented by various springs ; in the County area parts of Duston and Weston Favell are at present served by the Northampton Corporation. On the northern border of Northamptonshire, between South Kilworth and Stanford-on-Avon, the River Avon is expanded into a surface reservoir owned by the Borough of Rugby. No Northamptonshire villages are at present served from this source.

The remaining reservoirs of the County are constructed to feed the upper reaches of the canal system ; they are situated at Naseby, Sulby, Daventry (2) and Byfield. The Canal Companies have also considerable rights over streams adjacent to these reservoirs.

Of the artificial lakes perhaps the most important are Deene and Blatherwycke.

B. GEOLOGY.

Some reference must be made to the geological formation of Northamptonshire in order to give a rational account of the problems of its water supply. Scientific studies of the Geology of the County are to be found in the works of Sharp, Judd, Eunson, Beeby Thompson, and others ; and there is an admirable chapter on the subject in the first volume of the Victoria History.

Northamptonshire is built up of sedimentary rocks resting upon an old land surface of primary formations. The series consists chiefly of what are known as Jurassic rocks, lias and oolite, irregularly covered with deposits of varying thickness which belong to a later age. A schematic representation of the County would show a western ridge running from south-west to north-east and corresponding roughly with the high ground known as the Northampton Heights. From this ridge successive layers of the characteristic strata dip gently to the south-east, overlapping one another like slates on a roof. To the north-west of this ridge the typical formations of Northamptonshire do not extend to any distance, and their place is taken on the surface by formations of the Triassic and earlier periods. To the south-east the following strata are successively disclosed (reading from below upwards) :—

		Formation.	*Approximate maximum thickness in feet.*
Middle Oolite		Oxford Clay	200
Lower Oolite	Great Oolite	Cornbrash	15
		Great Oolite Clay	20
		Great Oolite Limestone	25
		Upper Estuarine Beds	30
	Inferior Oolite	Lincolnshire Oolite	85
		Lower Estuarine Beds	15
		Northampton Sand	60
Liassic		Upper Lias	180
		Middle Lias	98
		Lower Lias	520

As these strata gradually disappear from the surface, their place is taken by the cretaceous and more recent formations in the east and south-east.

Successive deposits of strata occur under marine or estuarine conditions, and the formation of any considerable thickness of rock-bed is dependent upon a quiet and continuous subsidence of the sea-bed on which the accumulations are taking place. So long as deposition and subsidence keep even pace, the formation of beds of uniform character progresses continuously. If subsidence diminishes or stops, while deposition continues, the depth of the water decreases and a change takes place in the character of the deposit. Conversely, profound changes occur if deposition lags behind subsidence ; and finally, if the bed is lifted above sea-level, the new land surface is exposed to the risk of denudation by atmospheric agencies, and the force of running water.

The operation of these conditions explains the phenomena presented by the sedimentary rocks of Northamptonshire—repeated change in the character of the beds, both vertically and horizontally : the absence of some members of the sedimentary series : and the unequal and capricious manner in which the existing series is distributed. These changes were determined by vast world-movements " in the dark backward and abysm of time," but the modern physical features of the county have largely been created by glaciation.

Before dealing with later periods, however, it will be convenient to consider the water-bearing strata of the consolidated sedimentary rocks. These formations give rise to three water-bearing layers separated from each other by impervious strata :

(i) beneath the lower lias clay.
(ii) between the upper and lower lias clay.
(iii) between the upper lias clay and the superficial formations.

(i) Supplies from beneath the impervious lower lias clay.

A number of deep borings have been made for various purposes, notably at Orton, Gayton, Kingsthorpe, and recently at Great Oxendon. The Orton boring was made for coal in 1883. The lower lias was penetrated at a depth of 666 feet and the old land surface reached at 715 feet. From this level 74 feet of volcanic rock was pierced before the boring was abandoned (415 feet below sea level). At Gayton a trial boring for water was made by the Northampton Waterworks Company in 1879, and a depth of 994 feet was reached (712 feet below sea level). The lower lias was penetrated at 581 feet, and the following strata were encountered :

Rhaetic	42 feet
Keuper	76 feet
Lower Carboniferous	190 feet
Old red sandstone (?)	105 feet

The same company made a trial boring for water at Northampton in 1879, and reached a depth of 851 feet (573 feet below sea-level). The lower lias was pierced at 738 feet, and after a further 67½ feet of Keuper deposits the old land surface was reached. Beneath this, 45½ feet of Carboniferous rocks were explored before the boring was abandoned.

At Great Oxendon a boring was carried down recently to 820 feet, penetrating the lower lias to reach Keuper deposits.

In the four cases quoted above, any water that was found was so heavily charged with salt as to be useless for domestic purposes. It is evident that deep boring in Northamptonshire is an unprofitable enterprise.

(ii) Supplies from the Middle Lias.

The strata of the middle lias lie, for the most part, between two impervious formations, the upper and the lower lias. To the extreme west, large areas of this formation outcrop on the surface, and south of the Nene valley the middle lias is relatively superficial but extensively covered by great masses of drift. As a superficial formation the water-bearing elements of the middle lias differ little from those of the Northampton sand to be described in the next section. In the centre of the County, however, where it is overlain by the impervious upper lias, it has become an important source of water supply. The lower lias, which is about 500 feet thick, contains no water, but certain beds in the middle lias, notably the marlstone, or uppermost rock-bed, have been extensively tapped for water supplies in Northamptonshire. This formation is of no great depth—less than 100 feet at the most—and its water bearing rock-beds are thin and variable. The upper bed is about 40 feet thick in the west near its outcrop, 21 feet at Northampton, and thins out a good deal to the east and north-east. In the central areas of the County the overlying upper lias clay affords good protection against pollution, but unfortunately the quantity of water available is uncertain, and deep wells in the marlstone have for the most part failed to provide an adequate supply in times of drought. Beyond the Nene fault to the south the marlstone sources have rarely been satisfactory, and as the strata are followed down the dip towards the south-east the water becomes progressively more saline. Recent borings at Tiffield, Paulerspury and elsewhere, have produced water so heavily charged with salt as to be unfit for use.

The middle lias provides a superficial source of water in its outcrop on the western uplands, and the canal reservoirs at Byfield, Daventry, Welford and Naseby, are fed largely therefrom.

(iii) Between the upper lias clay and the superficial formations.

The upper lias, which averages 180 feet in thickness, supplies no water but is useful for collecting springs from overlying sources. The most important water-bearing bed which lies on this formation is the Northampton sand ; the thickness most commonly found is 5 feet of sand above and 9 feet of ironstone resting on the upper lias clay. The Northampton sand is very porous, and large numbers of springs issue from its junction with the clay. Frequent slipping of this bed on the wet clayey slopes of hills gives rise to many springs at relatively low levels. Apparently, however, superficiality and weathering are essentials for supplies of quantity and good quality. As a deep-seated source of water, the Northampton sand is a failure, and where it has been pierced to some depth in easterly districts, the water is small in quantity and usually offensive in odour. The reservoirs for the water supply of Northampton at Ravensthorpe, for Kettering at Thorpe Malsor, and for Rushden and Higham Ferrers near Sywell, are all fed by springs from the Northampton sand as well as by direct rainfall. Owing to the extreme porosity of the formation, the water is usually derived from the lowest beds only.

Northampton sand cannot be regarded as a satisfactory general water supply for the County, for several reasons :—

(*a*) it is essentially a superficial source and is therefore liable to pollution.

(*b*) the strata are very variable in thickness, and the finding of abundant supplies in a given area is a lottery which brings more credit to the diviner than to the engineer.

(*c*) the permanence of ironstone supplies is rendered additionally uncertain by the fact that very extensive ironstone working is being carried on in many parts of the County, and springs and wells which appeared to be perpetual may be lost for ever by excavations.

Towards the north-east of the County the place of Northampton sand as a source of water is to a large extent taken by another member of the inferior oolite series—the Lincolnshire limestone. The thickness of the formation varies from a few feet to about 80 feet in the north of the County. In parts of Lincolnshire the supply of water from this source is very considerable, but in this County the variable thickness of the bed renders it unreliable. The great oolite series of clays and limestones covers a large area to the south and east of the river Nene, extending into Buckinghamshire and Bedfordshire. It is also well represented on the high ground between the River Ise and the River Nene, and to a less extent in the triangle between Kettering, Wellingborough and Northampton. As a whole, the great oolite series is not a good source of water supply. Where great oolite limestone is superficial, it is liable to give abundant springs immediately after rain which quickly run dry. When it is deep-seated, the amount of water available is limited by the fact that the rock is less fissured, and Mr. Beeby Thompson points out that its capacity to store and yield water is sometimes interfered with by marly horizontal divisions, so that water may be found at several horizons in the same series. The average thickness of the great oolite series is :

Upper Estuarine Beds	25 feet
Great Oolite Limestone	25 feet
Great Oolite Clay	10 feet

The uppermost member of this series, the Cornbrash, has an average thickness of about 5 feet in Northamptonshire, and is not a useful source of water supply.

To the east of the River Nene, comprising a considerable portion of Oundle and Thrapston Rural Districts and nearly the whole of Huntingdonshire, the lower oolitic formations give place to the middle oolitic, which for practical purposes consists of Oxford Clay. An outlier of the Oxford clay is to be found between Brigstock and Oundle. This mass of Oxford clay, probably reaching a thickness of 400 feet, does not yield water, and that is the reason why the plight of the Northamptonshire villages east of the River Nene is so serious.

Superficial Formations.

Up to this point we have dealt with formations which were consolidated in early geological times. There is little doubt that before the glacial ages Northamptonshire approached more closely geologically to the schematic form of strata described at the beginning of this chapter. That is to say, these formations were laid down under marine conditions, and at the end of this geological period the County was probably also covered entirely by Oxford clay and chalk. When land once more emerged at the end of the chalk period, the County slowly began to assume the physical conformation that we know to-day.

The agencies which brought about the present configuration of the County were largely atmospheric, and denudation of the newly-formed chalk and clay no doubt began to take place while the tertiary deposits were beginning to be formed farther to the south-east. From the point of view of water supply, the most important factors in this process were the glacial periods. Northamptonshire was probably near the southern boundary of the great ice sheet of the first glacial period, and immense floods created by melting of ice along the southern edges of the glaciers no doubt accounted for the removal of recently consolidated deposits of chalk and Oxford clay and their deposition as gravel filling many hollows, and the wide valleys of the Nene, Welland and Ouse. With the end of the first glacial period the floods would carry off towards the Wash all the finer materials previously included in the ice, and leave masses of coarser material spread over a large part of the County, but especially in the larger valleys. These drift gravels rest on the denuded surface of the more established strata previously described, and obscure their formations.

When glacial conditions set in for a second time, the changes of temperature were apparently more gradual and the period of glaciation longer, and probably the ice barrier extended further south. The consequent floods were less violent, and there was left behind a great mass of chalk and boulder clay derived largely from local material. Drift of this character can be found all over the County. sometimes reaching a thickness of more than 100 feet.

After the glacial periods many old valleys were filled in completely with boulder clay or glacial gravel, and new lines of drainage were formed. It is for this reason that we find the River Nene surrounded for a large part of its course by a deposit of coarse mid-glacial gravel, not brought down by the river itself but formed under glacial conditions before the Nene adopted its present course.

" If we stand on any of the bounding hills of the Nene Valley below Northampton, and look at the deep, wide excavation and then at the thin, scarcely distinguishable stream meandering through the flat meadows, and if we further take account of the occasional great floods, it is difficult to conceive that the river and the floods could have produced the results observed, for the river has little or no excavating power, and floods generally, if not always, deposit more silt in the valley than they carry away out of it ; in fact, the river and the valley are misfits."

The river gravels produced by the second glacial period were hardly distinguishable from the coarser mid-glacial deposits, and for our purposes may be considered together as a superficial source of water supply. When the extraordinary floods of the glacial age were over, ordinary flooding gradually deposited on the surface of these gravels fine sediment which filled up the hollows and created the wide, level valley through which the Nene winds to the sea.

We are now in a position to visualize a fourth and more important source of water supply in Northamptonshire as a great basin filled with porous glacial gravel, fed partly by direct rainfall but largely by superficial springs from ironstone and oolite formation, which lie upon the impervious surface of the upper lias clay along their margins.

The fact that these springs appear at varying levels in different districts, is due largely to the tendency of ironstone beds to slip on the underlying surface of clay which has been excavated by water, and indeed many of the hills in Northamptonshire are covered like a saddle with ironstone as a result of this process of slipping.

C. CORRELATION OF NATURAL FEATURES.

Correlating the geographical and geological data, we can now distinguish with some precision three water-bearing horizons in Northamptonshire.

(*a*) Deep wells and borings.
(*b*) Shallow wells.
(*c*) Superficial supplies.

(*a*) Deep wells and borings.

An essential part of the definition of a deep source of water supply is that it is tapped through an impervious stratum, and is therefore not exposed to pollution from the surface, provided that the walls of the well are rendered impermeable as they pass through the upper strata. The only practicable deep source of water supply in this County is, as we have seen the middle lias where it is overlain by the upper lias clay. Deep marlstone wells (using the term " marlstone " loosely to describe any water-bearing horizon in the middle lias) have been sunk in many districts such as Northampton, Ravensthorpe, Finedon, Berrywood, Towcester, etc. In some cases splendid results were obtained for a number of years, but a study of the history of many of these wells shows very clearly that the supply diminishes after a time, often progressively. Marlstone supplies did not, on the whole, respond well to the increased demand of building development and improved sanitation which occurred in the post-war years. I selected at random such particulars as I was able to obtain of twenty-five deep middle lias wells which have been sunk in various parts of Northamptonshire during the past fifty years. Fourteen of these were failures from the outset ; *i.e.*, the water was either brackish or insufficient in quantity. Six gave an indifferent supply, but sufficient for ordinary times for a small village. Five were reasonably satisfactory. The five successful wells in my series were at Ravensthorpe, Brackley, Long Buckby, Finedon and Towcester. Those who know these wells can judge whether I have adopted a high or low standard of success.

The conclusion that I have reached is that the middle lias is an unreliable deep source of water supply even in carefully selected sites, except for private houses and very small communities. Boring is relatively expensive, and the water-bearing strata are often missed, even when on theoretical grounds there seems to be a good prospect of success.

Widely varying results are obtained from wells sunk at quite short distances from each other, *c.f.*, Berrywood, Towcester and Tiffield, etc. It is interesting to note, in this connection, that Mr. Beeby Thompson put forward an ingenious method of supplementing the marlstone supplies by sinking dumb wells through the valley gravels of the Nene which are highly charged with water. This system has never been adopted, and it must be admitted that there is some doubt whether the marlstone has sufficient horizontal continuity to permit the storage over a wide area of water which percolates slowly downwards through the valley gravels.

(*b*) Shallow wells.

The distinguishing feature of this series is that the water is derived from an underground formation not protected above by an impervious stratum. Wells of this nature are therefore liable to pollution from the surface.

The most important strata of this series are :—

(i) in the west of the County, the middle lias, which in these districts lies near the surface or is covered only by unorganised deposits ;

(ii) in central areas, the Northampton sand. This formation may be superficial, or overlain either by unorganised deposits or by higher members of the inferior oolite series ;

(iii) in north-eastern districts, the Lincolnshire limestone ;

(iv) the great oolite limestone. This formation has a wide distribution both centrally and in the south-east of the County. It generally covers deep beds of Northampton sand, but is superficial and an unreliable source of water.

The Northampton sand is the most valuable member of this series and a dependable source of water.

It has the advantage of being covered, as a rule, with layers of natural filtering material, and is not in consequence so readily polluted as other shallow supplies. It is unfortunate, however, that the best ironstone supplies in chemical quality and in quantity are the most superficial. The distribution of ironstone beds is so variable, and its levels—largely on account of slipping—so unequal that its water cannot be collected for storage. Ironstone supplies may serve well for individual villages and as an auxiliary source of supply to surface reservoirs, *e.g.*, Ravensthorpe and Sywell.

The shallow marlstone supplies of the west are not so reliable as the Northampton sand ; towns and villages dependent on them have suffered a good deal during the drought.

The remaining supplies of this series are very variable, and none stands up to the test of a severe drought. There are few places in the centre of the County where shallow wells do not strike water of some sort, and individual houses may be tolerably well served from the great oolite.

(*c*) **Superficial supplies.**

The most abundant water supply in the County is derived from the valley gravels of the Nene between Wellingborough and Oundle. Moderate quantities are found elsewhere in scattered patches of drift gravels and sands.

The main sources of gravel supplies are rainfall, flooding and hillside springs which flow along the floor of the upper lias clay beneath the Northampton sand. At Irthlingborough, for example, the well is fed largely by a strong spring originating in Northampton sand and flowing through the town and its neighbourhood towards the Nene just south of the old bridge. I am informed that at one point near the well the river-bed is deeply excavated by the force of an inflowing current.

The objections to the use of the gravel as a reservoir of water supply are :—

1. The low level, making the use of pumps necessary.
2. The high degree of hardness (over 40° in the case of Irthlingborough).
3. The liability to pollution, owing to the superficial level, and proximity to the Nene and to various sewage disposal works. Valley gravel water is not safe.

Surface reservoirs form the next most important source of water, but I have already shown to what a very limited extent they can be constructed in this county. The most hopeful schemes for reservoir construction to serve considerable areas of the county, are the Northampton Waterworks extension, and the plan for building an impounding reservoir on the course of the Eye Brook.

Low-level impounding reservoirs are not a good source of water supply. In most cases pumping is required, and it is difficult to protect the catchment area from pollution. The water is, as a rule, of poor quality, and in times of drought, smell and taste are objectionable.

The remaining surface supplies are negligible, although it is to be noted (*c.f.* Rushden) that schemes have been brought forward in the past for the construction of impounding reservoirs at various points in the neighbourhood of Wellingborough.

D. CONDITIONS OF A SATISFACTORY WATER SUPPLY.

A good water should be

(*a*) moderately soft, without an excess of salts which cause permanent hardness ;
(*b*) free from taste or smell ;
(*c*) free from solids in suspension ;
(*d*) without action on lead or other metals ;
(*e*) rich in dissolved oxygen, and containing sufficient free carbon dioxide to give sparkle and vigour.

1. **Source.**

The sources from which water may be derived, in an approximate order of suitability for (*a*) drinking and (*b*) general domestic and trade purposes, are as follows :—

(*a*) DRINKING.	(*b*) DOMESTIC AND TRADE.
Artesian wells.	Mountain gathering grounds.
Deep wells.	Artesian wells.
Protected springs from deep sources.	Deep wells and springs.
Mountain gathering grounds.	

If none of the above sources is available, one must reluctantly fall back on :—

Rivers and streams.	Rivers and streams.
Stored rainwater.	Low-lying gathering grounds.
Low-lying gathering grounds.	Shallow wells and surface water.
Shallow wells.	

Speaking generally, incomparably the best sources of water in England and Wales are the upland surface waters of the Welsh Mountains, the Lake District, the Pennine Range, and the hills and moors of South-West England. The only risk of these waters, plumbo-solvency, can be guarded against without much difficulty or expense.

In some areas artesian and other deep sources yield water of fine quality, but their use must necessarily be confined to circumscribed areas. Water derived from sparsely populated mountain areas, where the underlying strata are impermeable, where there is little vegetable growth, and no risk of animal pollution, is the ideal supply for this country. Great cities such as Manchester, Liverpool, and Birmingham, have not been slow to realise these advantages, and their foresight has been rewarded by a permanent abundant supply of pure water.

It is convenient and economical to have the impounding reservoir at such a height that the whole area of supply can be fed by gravity. This can rarely be attained except in supplies from moors and mountains. An additional advantage is gained when compensation water can be used to provide power for any necessary works at the source. Moreover, in upland gathering grounds, with impervious strata which allow a high " run-off," the available quantity can be gauged with accuracy, and in many cases storage can be increased at relatively small cost, as the demand rises. In deep wells and other underground sources there is always an element of doubt as to the total quantity available, and recent studies of the deep water levels in Paris and the London basin have shown a disturbing fall in the general water level.

The source of supply should be situated where it is free from possible sources of pollution. Deep wells can, as a rule, be efficiently protected, but upland surface waters have the advantage that the risks can be gauged with certainty, and suitable preventive measures taken. Low-lying surface reservoirs, water derived from rivers in populous areas, and shallow wells, cannot be efficiently protected at all, and recourse must be had to some form of purification, thus raising the cost of maintenance.

The water at the source should be free from vegetable growths and chemical impurities likely to give rise to unpleasant taste or colour. In upland waters vegetable growths are few, and the risk of their establishment in the mains can be obviated by simple means. The tendency of these waters to dissolve lead can also be overcome by the addition of small quantities of lime. More serious troubles occur in low-lying reservoirs, partly owing to the presence of rank and decaying vegetation in and around the reservoir itself, especially during drought, and partly because of its tendency to spread to the transmitting mains.

Chemical impurities are largely found in underground supplies, and the quantity or nature of the solid residue may be such as to render the water unfit for consumption. This state of affairs is unfortunately all too common in Northamptonshire, where sulphur compounds are found in marlstone and deep ironstone wells. In many deep borings, especially south and east of the Nene, the excess of saline constituents has made the water undrinkable, *e.g.*, Kingsthorpe, 388 grains per gallon, Raunds, 219, and Paulerspury, 200. The more superficial supplies are frequently excessively hard, as at Irthlingborough (42°).

2. **Transmission.**

It is obviously economical and desirable to have an abundant supply of good water at short range. But this cannot be attained in the Midland Counties, and the very kernel of our problem is to decide whether it is better to face a large expense for a permanent supply of pure water from a distance, or to continue, as in the past, to explore the water resources of the County.

The Birmingham aqueduct is 73 miles long, and Manchester and Liverpool aqueducts 96 and 68 miles respectively. In other countries, including the Colonies, much greater enterprise has been shown—370 miles in Australia, 223 miles at Los Angeles, and 156 at San Francisco. Although this country has lagged behind in water supplies, the Lochaber power scheme, and the vast storage reservoirs in Galloway, show what we can do for public utility or private gain. The former scheme is estimated to cost about ten million pounds, and the latter will probably be at least that amount when it is complete. The Birmingham waterworks cost over seven million pounds, and to-day brings in a revenue of over £950,000. When one considers the enormous sums spent on railway development, electricity and other public services, it is astonishing that the revenue-producing commodity of water supply, so vital to public health and happiness, has been neglected. Admittedly, the first cost of a large scheme is very great, but if the design is sound, transmission and distribution should be low in maintenance. Multitudes of small schemes have high maintenance costs, and are unreliable owing to lack of co-ordination.

Where a regional supply by gravity cannot be obtained, it is necessary to resort to pumping to a service reservoir from which the supply is distributed by gravity. Electricity is the best source of power, because the action of the pumps can be automatically controlled. Oil engines are lower in fuel costs, but require more attention, and therefore a higher wages bill. Villages should be grouped together, wherever practicable, in order to avoid the multiplication of small pumping stations. Where there are large numbers of small schemes in an area, the problem of increased demand—say, in one of the villages which has suddenly developed a new industry—becomes very difficult. If the policy of separate undertakings continues, none of the smaller concerns can afford to increase its supply when it cannot be found in the immediate locality. The whole area should be connected to a single big reserve in some more richly endowed district. But this brings us once more face to face with the need for controlled planning, which will be discussed later.

3. **Distribution.**

In towns and larger villages there should be a piped supply to every house. It is sound in principle and works well in practice. When a new supply is installed, it is sometimes decided, for economy's sake, to connect a number of the houses directly to the rising main, and supply only certain areas from the service reservoir. This system is open to serious objection, especially in times of shortage ; it is much better, in the long run, to have an independent rising main.

In smaller villages a supply from standpipes is frequently all that can be given. This system has undoubted advantages where economy is the paramount consideration.

1. The consumption of water is less with a stand-pipe supply, owing, of course, to the extra labour of fetching the water.

Where the source of supply is not capable of giving more than five or six gallons per head, stand-pipes will be all that can be used.

2. A sewerage scheme is not necessary if stand-pipes only are used. This is an important advantage in a small village, but it must be remembered that even if stand-pipes are put in, people cannot be prevented from connecting to the mains, and as a rule, the larger house-holders soon do so.

Also, if there are sewers of any kind in the Parish, direct connections to the main do not necessarily mean a complete new sewerage scheme. Conversions from earth to water closets are often done very slowly, and until these are done, and baths are installed, old sewers are often quite sufficient to take sink wastes, etc.

3. The use of stand-pipes enables small house-holders to get water without being put to the extra cost of laying a connection to the main.

The latter cost may be about £5 for a pipe from the main to a tap over the kitchen sink, and this is a serious expenditure for a small cottager.

Consulting engineers generally recommend Councils to offer to pay the cost of connecting to the main, and for the length of pipe in the public road for all house-holders who will connect within say six months of the installation of the scheme This halves the cost to the householder, and encourages direct connection, which results in a better " water revenue."

Disadvantages of Stand-pipes.

1. A good pattern of stand-pipe, with anti-freezing device, costs £7 to £8. It is usual to fit them not more than 400 feet apart (as if further than 200 feet from a house, a water rate cannot be levied), and they are therefore rather expensive in any but the smallest villages.

2. The labour of walking backwards and forwards with buckets to the stand-pipe is a great disadvantage in a small household where the woman of the house has to do all the housework.

   The result is, that little water is used, baths are rarely possible, and the standard of cleanliness is necessarily less than with water laid on.

3. A direct water rate cannot be levied unless a stand-pipe is within 200 feet of a house (see P.H. Act (Water) 1878) : with direct connections a water rate can be levied on consumers, and they are, or should be, the only ones who pay for the cost of the schemes. Without a water rate, all have to pay, whether they use the water or not.

4. The general experience is that even if stand-pipes are adopted, householders quickly realize the benefit of a tap in the house, and begin to connect to the main. When one or two have done this, and the others see the advantages, they follow suit, and the stand-pipes become disused, and the expenditure on them is wasted.

5. They are always, to some extent, possible sources of leakage, and of trouble from frost. People are apt to leave the taps running, or at least dripping, and as they are no one's property, they are not always kept in good watertight condition.

   The automatic closing tap is satisfactory at first, but is more liable to get out of order than a common tap.

   One cannot say that stand-pipes should never be adopted, but they are, at best, a *pis-aller.* The standard of water supply which people expect is becoming higher and higher every year, and the stand-pipe will in time become a curiosity like the village stocks.

E. ANALYSIS OF THE NORTHAMPTONSHIRE SURVEY.

(*a*) **General.**

The most marked impression left on my mind by a first reading of the large volume of material accumulated for the survey, was one of amazement—at the courage and pertinacity of every one of the Boroughs and Urban Councils in trying to obtain a pure water supply for its citizens. Forty years ago there were no public supplies worth the name ; in that short period since the Local Government Act 1894, all these townships, undaunted by many failures, secured at great expense a water supply which seemed to have all the guarantees of permanence. Yet very few have come through the drought of 1933-4 unscathed. It is worthy of note, also, that there is only one example of co-ordination in these schemes—the Higham Ferrers and Rushden Water Board. This fault is due partly to the strongly individualistic tendencies of the various districts, and partly to the fact that no large reserves of water can be found in Northamptonshire. All the records go to prove that a given district would go any length rather than rely on its neighbour for water. Indeed, until the wise provisions of sections 56 and 57 of the Local Government Act 1929 were put into operation, there was no tendency to combine, even among parishes under the guidance of one District Council.

The difficulties which these Councils had to surmount may be illustrated by a few examples. Kettering and Finedon have suffered severely from the recent drought, while Irthlingborough and Raunds have come through triumphantly. But it was not always so—their histories are illuminating, and typical of the County as a whole.

Irthlingborough has an abundant supply of water and may be considered as one of the lucky ones ; yet it actually cost the town nearly £12,000 before the first success could be claimed. Raunds spent about £1,000 on experiment, before the gravel supply was adopted, and the total capital cost was at least £13,000.

Finedon was fortunate in striking a good marlstone supply in its early days, and other districts—even Irthlingborough—looked enviously in her direction. But the yield from the well steadily declined, so that the prime cost of £15,000 represents only a portion of the burden which the town will have to bear. Kettering purchased the Kettering Water Company's Undertaking in 1899 at a total cost of £148,111, and in 1904 the Thorpe Malsor Reservoir was completed, at a cost of £61,000. It seemed as if the Kettering Water problem was solved for ever. But to-day a further large expenditure is imminent.

The history of rural districts stands out in sharp contrast. Although the great Public Health Act of 1875 placed the responsibility for water supply on the District Council, the cost still fell on the parish ; and the District Council were naturally slow to move without the consent of the parish council.

Thirty years ago the usual method of obtaining a water supply for a village was as follows :—

(1) The Rural District Council, acting on a representation made by the Medical Officer of Health, or a public-spirited resident, informs the Parish Council that a public water supply is required.

(2) The Parish Council protests almost unanimously against a scheme on the grounds that (*a*) there is an ample supply of good water, (*b*) there is no evidence of evil results from the existing supply, and (*c*) all the inhabitants die of old age.

The scheme is then dropped for five years ; or the District Council, spurred to activity by the Local Government Board, proceed cautiously with the preparation of a plan, notwithstanding the parish protest. Sooner or later an engineer's scheme is prepared and sent to the parish, who protest :

(*a*) that it is too expensive ;
(*b*) that it is unnecessary ;
(*c*) that an alternative scheme at half the cost would be better ;
(*d*) that the scheme should at least be postponed until a more opportune time.

As a rule the scheme is carried out in the course of the next five or ten years, and finally everyone in the village wonders how they could have done without it for so long.

The parish was not to blame, but the system. By the beginning of this century the demand for sanitary improvements had far outgrown the resources of the parish. There was an urgent need for spreading the burden of charge, and placing the responsibility for water supply in the hands of a larger co-ordinating authority. But the parish system died hard, and it was not until the Royal Commission on Local Government reported in 1926, that a new basis of assistance was framed involving the co-operation of County Council, District Council and Parish Council.

(*b*) **Lessons of past history.**

An unhappy feature of the history of the County's water supply, as shown by the survey, is the large amount of money spent on unrealised hopes. The four areas already quoted bring this out very clearly, but many smaller areas have suffered just as severely. We can compute the cost of past schemes only very roughly, as a good deal of unrecorded expenditure has been incurred, especially on unsuccessful trials. The following table, however, may be regarded as the minimum capital cost of schemes which have been paid for out of loan.

District.	*Population.*	*Cap. Cost.*
		£
Brackley B.	2,181	12,000
Daventry B.	3,609	12,853
Higham Ferrers B. (See Rushden)		
Burton Latimer	3,587	15,000
Desborough	4,407	23,600
Finedon	4,100	17,000
Irthlingborough	4,715	13,051
Kettering	31,220	212,000
Oundle	2,001	8,000
Raunds	3,683	12,908
Rothwell	4,516	22,000
Rushden	14,248	110,000
Higham Ferrers	2,930	
Wellingborough	21,223	63,000
	102,420	521,412
Northampton C.B.	92,341	645,000
TOTALS	194,761	1,166,412

Not one word of blame can be attached to the districts which have tried and failed. They did the best that could be done on the scientific and engineering evidence before them. It was only by trial and error that the limitations of Northamptonshire's resources could be discovered ; it was only the hard experience of drought that could bring out the hidden faults of an apparently sound supply. The costly failures of the past should make us pause before embarking on enterprises which draw further on our depleted underground sources. It is for this reason that the Consulting Engineers of the County Council tend to rely more and more on springs which can be accurately gauged, and yield substantial amounts of water even after a long drought. There is in this an advantage that the major part of the expense lies in service —the cost of reservoirs and mains—and not in boring operations. There is considerable evidence that excessive pumping from the marlstone layer has altered for the worse the chemical constituents of this water, and increased the area of water highly charged with mineral constituents. In this connection Beeby Thompson's proposal that the middle lias supplies should be constantly restored through dumb-wells from the gravel has an added weight.

(*c*) **Existing Conditions.**

The past three years have witnessed a remarkable advance in co-operation. The County Council at once shouldered its responsibilities under the provisions of section 57 of the Local Government Act, 1929. A policy was adopted whereby the Council should contribute from 10 to 40 per cent of the net annual deficiency on any approved scheme, provided that its cost, had it been borne by the contributory place alone, would have raised the local rate above 1/6d. in the £1. This provision has been largely used and Rural District Councils have undertaken their share of contribution. During the current year there has been a considerable movement towards water schemes on a wider basis, and the tendency of the more progressive councils has been to spread the cost of new schemes over the whole district. This method is particularly applicable to regional schemes, such as have been brought forward by Daventry, Oundle and Thrapston Councils.

A closer examination of the reports shows that, of the existing urban schemes, the following provide ample water and are capable of extension to other areas :—

	Requirement	*Approximate Yield*
Irthlingborough	100,000	200,000
Raunds	60,000	170,000

These towns derive their supply from the valley gravels, augmented, in the case of Irthlingborough, by springs from Northampton sand. Oundle has a similar supply which could no doubt be extended by sinking another well in the gravel and connecting it with the existing system.

The following districts have sufficient water for their present needs, and probably enough to meet the moderate demands of their own prospective development :—

Brackley Borough	(Marlstone).
Wellingborough	(Borings in Northampton sand).
Oundle	(Valley gravel).
Rothwell	(Northampton sand).

The following districts have insufficient supplies to meet their present or prospective needs. That is, during the past twelve months they have had to restrict their supplies, seek emergency additions, or issue shortage warnings :—

Burton Latimer,
Finedon,
Kettering,
Desborough,
Higham Ferrers,
Rushden,
Daventry.

In the Rural Districts there are 121 public or private piped supplies. The following have given an ample yield, capable of extension to other areas :—

KETTERING RURAL DISTRICT.

Pytchley (Supply extended to serve Broughton).
Stanion.

OUNDLE RURAL DISTRICT.

Apethorpe. Private supply owned by Sir Leonard Brassey, recently greatly augmented, and capable of extension throughout Kings Cliffe, Woodnewton, and possibly other villages.

THRAPSTON RURAL DISTRICT.

Woodford. Abundant valley gravel supply, which the Council have already extended to Twywell and propose to utilise for a large regional scheme.
Islip. Ironstone springs and valley gravel.

POTTERSPURY RURAL DISTRICT.

Hartwell. Supply extended to Ashton during 1934, but not capable of further use.

NORTHAMPTON RURAL DISTRICT.

Little Billing. Capable of extension to Great Billing only.

The following districts have public or private piped supplies (not including incomplete services to a few stand-pipes) which have proved sufficient for the needs of the area served :—

BRACKLEY RURAL DISTRICT.

Aynho, Evenley, Farthinghoe (recently completed).
Greatworth and Marston St. Lawrence (Public Supply from a spring in Greatworth parish).
Newbottle (Charlton).

BRIXWORTH RURAL DISTRICT.

Althorp, Chapel Brampton, Church Brampton, Brington, and
Harlestone (private supply from Althorp Estate).
Boughton.

CRICK RURAL DISTRICT.

Stanford-on-Avon.

DAVENTRY RURAL DISTRICT.

Ashby St. Ledgers.
Badby (public supply from springs in the middle lias).
Catesby.
Farthingstone (public supply from a spring).
Norton.
Preston Capes.
Winwick.

EASTON-ON-THE-HILL RURAL DISTRICT.

Easton-on-the-Hill.

GRETTON RURAL DISTRICT.

Gretton, Laxton, Rockingham (Private supply from ironstone spring in the Castle Estate).

HARDINGSTONE RURAL DISTRICT.

Brafield, Castle Ashby, Denton, Horton, Whiston, Yardley Hastings.

KETTERING RURAL DISTRICT.

Broughton, Corby, Middleton, Pytchley, Rushton, Stanion, Thorpe Malsor.

MIDDLETON CHENEY RURAL DISTRICT.

Aston-le-Walls.

NORTHAMPTON RURAL DISTRICT.

Little Billing, Harpole, Kislingbury.
Weston Favell and Duston—from Northampton Corporation.

OUNDLE RURAL DISTRICT.

Apethorpe, Ashton, Benefield, Bulwick, Kings Cliffe, Lilford, Pilton, Wadenhoe.

OXENDON RURAL DISTRICT.

Great Oxendon.

POTTERSPURY RURAL DISTRICT.

Old Stratford, Hartwell, Wicken (Private supply), Yardley Gobion (Recently installed supply from springs).

THRAPSTON RURAL DISTRICT.

Brigstock, Islip, Lowick (Drayton Estate), Slipton, Sudborough, Thrapston, Woodford.

TOWCESTER RURAL DISTRICT.

Blakesley, Cold Higham, Easton Neston, Gayton, Greens Norton, Litchborough, Maidford, Towcester.

WELLINGBOROUGH RURAL DISTRICT.

Easton Maudit, Hardwick, Irchester, Wilby, Wollaston.

The following public and private piped supplies have had difficulty in coping with the demand during the drought, and restrictions have been imposed, or warning notices issued.

BRACKLEY RURAL DISTRICT.

Eydon, Hinton, Moreton Pinkney, Whitfield.

BRIXWORTH RURAL DISTRICT.

Cottesbrooke, East Haddon, Haselbeech.

DAVENTRY RURAL DISTRICT.

Charwelton, Long Buckby, Woodford-cum-Membris.

HARDINGSTONE RURAL DISTRICT.

Courteenhall, Hardingstone, Little Houghton.

KETTERING RURAL DISTRICT.

Barton Seagrave, Cottingham, Grafton Underwood, Thorpe Malsor*, Warkton, Weekley.

* *This village has a priority claim to Kettering's supply, so the shortage has not been actually felt.*

MIDDLETON CHENEY RURAL DISTRICT.

Lower Boddington, Middleton Cheney (Overthorpe).

NORTHAMPTON RURAL DISTRICT.

Nether Heyford, Upper Heyford.

OXENDON RURAL DISTRICT.

Arthingworth, East Farndon, Kelmarsh.

POTTERSPURY RURAL DISTRICT.

Potterspury.

TOWCESTER RURAL DISTRICT.

Abthorpe, Stoke Bruerne.

WELLINGBOROUGH RURAL DISTRICT.

Earls Barton, Ecton, Isham.

All the above districts have at any rate had the benefit of piped water supplies in the past. The following parishes, which have no piped supplies, have suffered more or less severely from shortage. The standard of comparison is of course much lower in these villages. Shortage is a relative term, depending on the quantity which one normally considers sufficient. Many of the reports from parishes suggest a very primitive notion of what is meant by sufficiency, and I had difficulty in assessing at their true value such expressions as " a good supply," " no complaints received," or even the less ingenuous phrase, "satisfactory so far as it goes." I was obliged to make personal investigations into a number of these replies, but it was impossible to deal with all.

Reports of shortage in 1934.

Brackley Rural District.

Croughton, Culworth, Helmdon,
Kings Sutton, Sulgrave, Syresham,
Thorpe Mandeville.

Brixworth Rural District.

Brixworth, Cold Ashby, Coton,
Creaton, Draughton, Guilsborough,
Hanging Houghton, Hannington, Holcot,
Holdenby, Lamport, Maidwell,
Moulton, Old, Pitsford,
Ravensthorpe, Scaldwell, Spratton,
Thornby, Walgrave.

Crick Rural District.

Clay Coton, Lilbourne, Yelvertoft.

Daventry Rural District.

Braunston, Dodford, Everdon,
Flore, Staverton, Watford,
Weedon, Welton, West Haddon.

Gretton Rural District.

Wakerley.

Hardingstone Rural District.

Cogenhoe, Hackleton, Great Houghton,
Milton, Piddington, Roade,
Rothersthorpe, Wootton.

Kettering Rural District.

Cranford, Cransley.

Middleton Cheney Rural District.

Upper Boddington, Chacombe, Chipping Warden,
Middleton Cheney, Warkworth.

Northampton Rural District.

Great Billing, Bugbrooke.

Oundle Rural District.

Armston, Barnwell, Cotterstock,
Hemington, Luddington, Lutton,
Polebrook, Thurning, Woodnewton.

Oxendon Rural District.

Braybrooke,
Clipston,
Sibbertoft,
Stoke Albany,
Sutton Bassett,
Wilbarston.

Potterspury Rural District.

Grafton Regis,
Paulerspury.

Thrapston Rural District.

Great Addington,
Little Addington,
Aldwincle,
Chelveston,
Clopton,
Denford,
Hargrave,
Ringstead,
Stanwick,
Titchmarsh.

Towcester Rural District.

Blisworth,
Shutlanger,
Silverstone,
Wappenham,
Weston and Weedon,
Whittlebury.

Wellingborough Rural District.

Bozeat,
Great Doddington,
Grendon,
Great Harrowden,
Little Harrowden,
Mears Ashby,
Orlingbury,
Sywell.

It is abundantly evident from these returns that Northamptonshire towns and villages have been in a serious plight for lack of water, and carting of supplies has been undertaken in a number of places, notably the villages which lie on the Oxford Clay to the East of the Nene. A more serious feature of the situation is the extreme difficulty of finding a remedy, even with the assistance of able engineers, and all the eagerness and good will of Councils which are ready to make great sacrifices to provide water supplies. During the recent drought available water supplies could not be found, and in the next dry period, perhaps ten years hence, the difficulty will recur in an accentuated form.

The Daventry Rural District Council, for example, made a determined effort to meet all their deficiencies, preferably by means of regional schemes. Up to a point they were successful, and satisfactory schemes are in preparation for West Haddon, Crick, Yelvertoft, Kilsby, Lilbourne, Watford, etc. But in the case of Braunston no real solution of the problem could be found at all, except at prohibitive cost.

It would be interesting if one could make up accurate statistics for the county, comparing the number of successful water schemes with the number of failures. Such figures cannot be prepared, but there is no doubt that the number of failures is overwhelmingly great. One need only cite the number of vain attempts made by various authorities before they succeeded at all—*c.f.*, Rushden, Raunds, Northampton, Irthlingborough, etc.—and the number of " successful " schemes which ultimately failed. Among these may be included Finedon, Kettering, Burton Latimer, Earls Barton and many village supplies.

It would be of great interest also, if one could compute accurately the total cost of our water supply, assuming that every sizeable parish were to have a piped supply. It is only possible to frame a very rough estimate that the average cost of local or small regional schemes is approximately £3 per head of the population in rural areas, and £5 per head in Urban Districts.

This estimate assumes that every scheme is immediately successful, and that its results are permanent. Unfortunately there is no evidence which would lead us to make these assumptions. The Rushden and Higham Ferrers scheme cost £100,000 for a population of 22,331 and new expenditure is imminent. The Kettering supply cost £212,000 for a population of 31,000 and conditions during 1934 amounted to a serious water famine.

(*d*) Summary of Projected Schemes.

Many schemes of water supply have taken shape during the past two years in order to deal with shortage. Some of these were emergency measures, while others contemplated a permanent addition to the resources of the area. Others again aim at the provision of wholly new supplies to meet the growing needs of large areas. The principal schemes are :

(1) THE EYE BROOK SCHEME. The most carefully planned scheme to serve a large area of the County is the proposal of the Corby and District Water Company. This company has obtained Parliamentary powers to construct a reservoir on the Eye Brook near Caldecott, and it is suggested that a Joint Water Board be formed for the distribution of this supply.

The capacity of the reservoir is to be at least 1,700 million gallons, and the estimated gross yield is six million gallons a day.

The Kettering U.D.C. are entitled, under the 1931 Act, to demand 500,000 gallons a day. The Hallaton R.D.C. and the Uppingham R.D.C. can demand 25,000 and 50,000 gallons a day respectively.

The amount of compensation water has been fixed at 700,000 gallons a day. It is anticipated that the Corby Steel Works, which have a priority claim to the supply, will require from one to one and a half million gallons daily, but no figure has been fixed.

On the basis of the above figures, the surplus for regional distribution would be 3,225,000 gallons per day—a quantity sufficient to afford 15 gallons per head per day to the whole population of the Administrative County. It would therefore be ample to make up any local deficiencies and act as a great county reserve.

The scheme was prepared before the drought by the eminent engineer, the late Dr. Lapworth. I understand that it was based on an average rainfall of 25 inches to 27 inches per annum, and a loss by evaporation of 15 inches. Even if we assume that Dr. Lapworth would have modified his results after observation of the serious diminution in the gaugings of the Eye Brook during 1934 (205,000 gallons, as compared with 830,000 gallons in September 1930), the surplus would still amount to over two million gallons. The object of constructing such a large storage reservoir is to provide a reserve to make up the yield in the dry season of the year. The reservoir alone would give a supply of six million gallons a day for a period of nine months.

A very rough estimate of the cost of " raw " water, based on a yield of 4 million gallons daily, would be 4d. per thousand. To this may be added 3d. for rates and management, and 4d. for pumping, filling, and softening. The total cost at or near the source may be estimated at about 11d. per thousand gallons.

Distribution cost over long distances would be immoderately high unless large consumers such as Northampton, Kettering and Wellingborough joined the scheme, and so contributed largely to the expense of the trunk mains. For many smaller areas it would probably be necessary to " boost " the water after taking it from the trunk main, in order to obtain adequate pressure.

The total cost of the scheme at the source would probably amount to £340,000.

(2) DEVELOPMENTS AROUND NORTHAMPTON. Northampton Corporation have a statutory authority to supply considerable areas in Brixworth, Northampton and Hardingstone Rural Districts, but the only districts actually served are Weston Favell and Duston.

There is much to be said in favour of a regional scheme from a central source of supply ; and a large Water Authority, such as Northampton, is in a position to maintain an ample supply by constructing new reservoirs or wells, or by taking a supply from other Authorities.

The principal difficulty, from the point of view of cost, would be the construction of one or more new service reservoirs at a higher elevation than the present one at Boughton, and the great lengths of main to relatively small villages. The expense of serving the Southern districts would be correspondingly greater owing to the difficulty in reaching a high level for service.

(3) THE OUNDLE REGIONAL SCHEME. The object of the scheme is to give a permanent water supply to the group of villages which lie on the Oxford Clay to the East of the Nene. The proposed source of supply is a well in the river gravels of the Nene, probably near Barnwell. Water would be pumped through Barnwell to an elevated water tank on the high ground between

Barnwell and Hemington, and distribution mains laid from there to Polebrook, Hemington, Lutton, Thurning, Luddington, Clopton and possibly certain villages in Huntingdonshire. The cost of the scheme, including Clopton, would fall not far short of £14,000—to serve a population of 1,116. This is admittedly a very high first cost, but there is no conceivable alternative. The water shortage in this area is seasonal, and not merely acute in periods of exceptional drought.

(4) THE THRAPSTON REGIONAL SCHEME. Thrapston Rural District Council have taken a prominent part, in recent years, in the promotion of regional water supplies. The search for a supply to the village of Woodford led to the discovery, in the valley gravel, of a source which yielded almost 750,000 gallons a day. The Council seized this fine opportunity to promote a service to the villages in which water shortage has long been felt.

In the first instance the village of Woodford was supplied. In 1934 the water shortage at Twywell became so acute that mains were laid to that village in anticipation of the full scheme. The Regional supply now under consideration is to serve, in addition to the above, the villages of Great and Little Addington, Denford and Ringstead. The estimated cost (including Twywell, but not Woodford) is £14,500.

The villages of Titchmarsh and Aldwincle in the North, and Chelveston and Hargrave in the South, will probably be dealt with apart from the main scheme, and the matter is now under consideration.

The well at Woodford is at any rate an excellent reserve source for a wide area.

(5) WESTERN REGIONAL SCHEME. The Daventry Rural District Council resolved to deal comprehensively with their district, including the Crick area which will be added in April 1935. With the co-operation of the Crick Council, the main scheme was promulgated to serve the villages of Watford, West Haddon, Crick, Yelvertoft and Kilsby. As the whole area is still under investigation, it is not possible for me to deal with it with any sense of finality. Many alternatives were considered by the Council's Consulting Engineers, and it appears probable that the main scheme will also include Braunston and Welton, and possibly Lilbourne.

The essence of the scheme is to collect water from springs in the neighbourhood of West Haddon, and pump to a service reservoir on the high ground above that village. From there mains will be laid to give a supply by gravity to the area. The capital cost may be roughly estimated at £3,000 for each village.

Subsidiary regional schemes are also designed for (*a*) Weedon and Flore and (*b*) Byfield and Charwelton. These schemes are not sufficiently far advanced to set out in detail.

F. PLANNING FOR THE FUTURE.

If we trace the history of the water supplies of this Country from the great Sanitary Survey of 1841 to the present day, we cannot fail to recognise two well marked lines of development. The first is from chaos to the co-ordination secured by the Public Health Act 1875 ; and the second, a progressive movement from the parish as a unit to the District Council, the County Council, the Regional Committee, and finally, as foreshadowed by a recent decision, to the National Executive.

For our present purposes history begins with the Act of 1875, which established the provision of a pure, adequate, and accessible water supply as a function of the local sanitary authority. The powers of the towns were defined by the Local Government Acts of 1888 and 1894, and, so far as individual effort can succeed, the Boroughs and Urban District Councils did all within their power to provide good and abundant water. The Rural District Councils, on the other hand, were faced with a far more difficult situation. For many years the parish continued to be arbiter of its destiny in sanitary matters, and yet it was evident that few individual parishes had either the resources or the technical capacity to provide a water supply. In most areas the District Councils gave assistance in many ways, but the ' burden of the contributory place ' was too heavy for parish shoulders. The idea of co-ordination between neighbouring parishes, or co-operation with towns, was slow to emerge. After the Great War external circumstances took control of the situation, and the rapid increase in housing development made the old policy of isolation impossible. The Royal Commission on Local Government, which reported in 1926, saw the changing situation clearly and adopted as a fundamental principle of its recommendations that the burden of charge for water supplies and general sanitary works should be spread over a wider area. These recommendations were embodied in Sections 56 and 57 of the Local Government Act of 1929, which permitted Rural District Councils and County Councils to contribute out of their general rate to works of water supply and sewage disposal. Increased borrowing powers gave added facilities for spreading the charge and undertaking more comprehensive schemes. These powers have been extensively used and have had the anticipated effect in many areas of encouraging the development of regional water schemes on the wider basis of a general district rate.

At this point Nature intervened. A hundred years ago she drove the Country into sanitary legislation through fear of Cholera ; on this occasion an abnormal drought mercilessly exposed the failings of local water undertakings.

The Government offered substantial assistance to Rural Districts in order to encourage them to embark on schemes of permanent value. With the triple aid of Exchequer, County Council, and District Council a considerable number of small parish and regional schemes were prepared, and useful work was done. Yet the very effect of these provisions was to show that the water problem was too narrowly conceived. There was some hasty talk, it is true, of a water " grid," on the analogy of our immense electricity undertakings. The idea of a grid for water is an " Aunt Sally," hardly worth the wit that was spent in knocking it down. " Water," it was said, " can be obtained only where nature put it, and it cannot be made to flow uphill." This amiable controversy over " the grid " served, for a time at any rate, to conceal the truth which lay behind the fantastic idea : that the real and urgent need of the Country is National Zoning of our water resources. National planning and deliberate conservation of the available water resources of England and Wales could provide every area in the Country with an abundant supply of pure water.

Quite recently an eminent authority, in answer to the question, " Is there a water problem," set out the following propositions :—

" (1) There is a water problem.
(2) It is more regional than national.
(3) It is intermittent and largely confined to drought years.
(4) It can be solved by reasonable economy and the solution is therefore largely in the hands of the consumer.

(5) The solution is (*a*) co-operation with the consumer ; (*b*) metering garden and hose supplies ; (*c*) extension of the use of meters."

It may well be that this facile solution is applicable to millions of consumers. It certainly has no bearing on the problem of the Southern and Eastern Midlands. In any case, I cannot take such a gloomy view of the foresight and enterprise of the nation as to believe that it will allow a water shortage to be cured by the extended use of meters. In the Midlands the water shortage is in some places intermittent, and in others perpetual. In all places, like malaria and other intermittent diseases which demoralise a whole people, it cannot be cured by palliatives. The cause must be sought out and eradicated. Our water is not merely insufficient ; it is poor in quality, and unsuitable for trade and general domestic purposes.

The second proposition—that the problem is more regional than national—deserves closer examination. If it is intended to mean that the cause of the problem is regional, no exception can be taken. If it is argued that the solution also is regional, one must join issue at once.

Regional water committees have been formed in the past, and in the year 1934 further co-ordination of this nature has been attempted—notably by (*a*) Lancashire, Cheshire and part of Derbyshire, and (*b*) Staffordshire, Warwickshire and Worcestershire.

These Regional Advisory Water Committees are to be " purely advisory in character. Their functions should be (*a*) to carry out a comprehensive survey of the future requirements of water supply in their areas for a long period of years, and to formulate proposals for meeting these requirements for the consideration of the bodies concerned ; (*b*) to advise in the preparation and co-ordination of schemes of water supply within their area." It is not stated what expert and other advice the committees are to have in performing their functions, but it is emphasised again and again that they are to have no executive powers.

I have earnestly studied the published reports concerning advisory water committees, in order to discover whether there was any expression of a common desire to help (*a*) areas which more or less constantly live under the shadow of water shortage or (*b*) areas which, owing to their geographical or financial situation, are unable, without the help of a stronger hand, to provide for their citizens a good and ample supply of water. The only authoritative *obiter dicta* that I could discover from the press reports of these conferences were :—

" This is a purely advisory and not an executive body. It is not going to be a water-board . . . it is not going to be a stepping-stone to a general distribution of Birmingham and South Staffordshire water for the area." (Birmingham.)

" Smaller authorities should not be encouraged to climb on the backs of larger authorities." (South Staffordshire.)

At the Lancashire Conference, on the other hand, the Chairman of the Manchester Corporation Waterworks Committee said that " it was only by co-ordination that full benefit could be derived from the water resources of the Country, and he looked forward to the division of the Country into definite areas, with statutory water boards controlling each and charged with the responsibility of supplying every user of water at a reasonable cost." This hope, expressed by Sir William Kay, can be realised only by National Zoning and Control of our water resources.

The constitution of regional advisory committees is a sincere attempt to improve local water supplies by applying to their organisation the knowledge and breadth of view which a co-ordinating body has at its disposal. But their functions are limited, and they offer no hope of progress towards the ideal of national planning and control. Regional advisory committees without executive functions will, I believe, hinder progress just in so far as they create in the minds of Local Authorities the impression that no further steps need be taken. They may flourish for a time, but they will bear no fruit.

The suggestion that the problem of water supply for the Midlands could be solved by National Zoning is not a mere web of fantasy. It is a genuine, practical, and urgent proposition.

The average annual rainfall in the mountains of Central Wales is about 67 inches ; in Warwickshire 28 inches ; in Northamptonshire 25 inches ; and in Huntingdon 22 inches. A period of drought is always relatively much more severe in the East, and in Huntingdonshire the average rainfall in 1921 was only 11½ inches—50 per cent. below normal, as compared with a deficiency of 31 per cent. in England. Central Wales has immense catchment basins, only a few of which have been utilised for any purpose. The nature of the gathering grounds and the impermeability of underlying rocks favour the storage of enormous quantities of water without injuring fishery rights or those of riparian owners. In fact, the construction of large storage reservoirs is a benefit to down-stream users, as the agreements for compensation water ensure an adequate flow even in dry seasons.

If these magnificent reserves of water are placed under National control, the first and most important step in forward planning will have been taken ; if not, the opportunity will be seized by others and lost to the Nation for ever.

The second step is to determine the size of a Midland zone and the number and distribution of the population which would benefit by a pure water supply. In taking this step one must not forget that many populous areas in Warwickshire and Northamptonshire already have, from more or less local sources, enough water of a kind—but not to be compared with mountain supplies in purity or general fitness for domestic and trade purposes. Coventry, Nuneaton, Rugby, and large tracts of eastern Warwickshire, lie within the zone ; and farther to the east, the Counties of Northampton, Huntingdon, and the wide areas of fenland. It is idle to speculate at this time how many of the larger authorities would seize the opportunity, if it were offered, of obtaining a permanent supply of pure water from the mountains of Wales.

One must, therefore, concentrate on the needs of Northamptonshire. The population of this County is for the most part confined to a central industrial triangle. The base of this triangle extends from the largest town—Northampton—through Earls Barton to Rushden, passing close to Wellingborough, Irchester and Wollaston. The eastern side passes through Higham Ferrers, Irthlingborough, Finedon, Burton Latimer, Kettering and Rothwell, to the apex at Desborough. Close to the base and eastern side of this triangle there is a population of approximately 205,000, including :—

Northampton and neighbourhood	100,000
Kettering area (including Desborough, Rothwell, Burton Latimer and Corby District)	48,000
Wellingborough area (including Finedon, Irthlingborough, Earls Barton, Wilby, Wollaston, etc.)	31,000
Rushden area (including Higham Ferrers, Raunds, Irchester) ...	24,000

This area is really very compact, and there are no great distances between individual towns. Northampton to Earls Barton is the longest distance, but a water main already runs from Sywell to Earls Barton, and Higham Ferrers, Rushden, Irchester and Wollaston, are linked with this main. The remainder of the population of the County is largely non-industrial and much more widely scattered, but a considerable portion of this is not outside the range of a large regional supply.

Water consumption per head of the population is a very variable figure depending on many factors, but with an eye to the future one may suggest thirty gallons per head for industrial towns and twenty gallons for non-industrial towns and villages. On that basis the total requirement of the industrial triangle is well over six million gallons a day, and indeed it is possible that Corby alone may require a supply of almost two million gallons daily. The Rural areas, if it were possible to link them up with a general supply, would require approximately two million gallons. If one were to devise a scheme to serve Northamptonshire and certain areas farther east, an estimate of not less than ten million gallons a day would be necessary. I estimate the population of the zone east of Birmingham of at least three-quarters of a million, that is, taking the population within a reasonable distance of a line drawn from Coventry to Huntingdon. If there were real co-ordination and national planning, a line of this kind might well be designed to convey from the source not less than twenty-five million gallons of water a day. So far as the capacity of the source is concerned, this quantity is inconsiderable. The difficulty lies in securing a sufficient number of authorities able and willing to guarantee the cost of laying mains, and it seems obvious that the initial cost of a scheme of this size would be quite beyond the financial capacity, or the co-ordinating powers of the authorities which lie within the zone that I have so roughly described. In other words, the scheme at which I have hinted in such vague outline is only possible by means of National Planning, National Control, and assistance, for a time at any rate, from the National Exchequer.

I do not suggest that the scheme outlined above is the only possible one for this County. It may be that a regional supply should come from the north through Leicestershire. That is another reason why planning on a national scale is so important.

It would be entirely outside my province to go further into detail in suggesting a zonal water supply for the Midlands from the mountain gathering grounds of central Wales or elsewhere. But certain features of the existing situation deserve emphasis :—

(1) The water shortage in Northamptonshire, East Warwickshire, and Huntingdon, is serious and progressive. The available supply is becoming less and less able to meet the existing demand, let alone the increasing consumption which is inevitable. The next drought, say in ten years' time, will show a further shrinkage in reserves.

(2) The difficulty of finding adequate supplies of water in Northamptonshire is of old standing, and has been referred to by experienced engineers for the past thirty years.

(3) The existing water supplies of the County are of poor quality, mostly liable to pollution, and in many cases so hard as to be unsuitable for trade and general domestic use.

(4) The only new sources of water available within a reasonable distance of the County are open to the same objections as the existing supplies.

(5) A very large capital expenditure has been incurred during the past thirty years in schemes of water supply ; yet only a very small proportion of these schemes stands unshaken to-day.

(6) Large sums in the aggregate are spent year by year on maintenance of hosts of isolated water undertakings—and the total of pumping costs throughout the area is a heavy burden.

(7) There is ample water in Wales to serve the whole of the Midlands. The problem is one of distribution. It is immensely difficult, but I believe it can be solved by national planning.

There remains the question of expenditure already incurred : If we are to become participants in a great regional scheme, what is to happen to all that has been laid out in the past on impounding and service reservoirs, wells and borings, pumping stations and mains ? This difficulty is not so serious as might be anticipated. It is true that impounding reservoirs could not be employed, except for subsidiary purposes, but service reservoirs and mains could be largely used. There would be considerable savings on maintenance.

If there is the remotest possibility of a large regional scheme, how far is it wise to proceed with the smaller unit and area schemes which have been brought forward during the recent drought ?

Every scheme which has been promulgated in the last three years has been examined from the wider viewpoint. By far the greater part of the expenditure sanctioned has been upon service reservoirs and distributing mains, which would serve equally well for a regional scheme. The construction of impounding reservoirs, or a heavy expenditure on boring operations, would probably be discouraged in the Administrative County, but area schemes and other measures of co-ordination within the county will form an important link between the present and the future.

G. WATER SUPPLY AS A SOCIAL STUDY.

We have considered the problems of our water supply hitherto from the scientific standpoint, and touched on the financial difficulties. But no study would be complete without reference to the social implications.

We have to estimate the value of water to the life and well-being of the community. Is it worth while making immense sacrifices to secure an abundant supply of good water for all? Our generation has made astonishing progress in the provision of social services: what is the true place of water in these services? Can we safely ignore water supply, while slums are cleared, overcrowding conquered, and vast new housing estates created; while transport facilities increase (literally) by leaps and bounds; while electricity and gas become a commonplace in every home? Can we stay the ever-increasing demand for water by all classes, peradventure by imposing artificial restrictions?

If we measure the progress of material civilization by the common enjoyment of things which make life kind, ancient Rome was far ahead of the England of the nineteenth century. In water supply alone the Roman service in the early days of the Empire would have amazed London of 1850, and the public baths would have put the whole of England to shame. In 1842, Liverpool (thanks to Kitty Wilkinson) was the only town which could boast of cheap baths and wash-houses.

" The whole family of the labouring man in the manufacturing towns rise early, before daylight in winter time, to go to their work; they toil hard, and they return to their homes late at night. It is a serious inconvenience, as well as discomfort, to them to have to fetch water at a distance out-of-doors from the pump or the river on every occasion that it may be wanted, whether it may be in cold, in rain, or in snow. The minor comforts of cleanliness are, of course, forgone, to avoid the immediate and greater discomforts of having to fetch the water." So Chadwick wrote in 1842.

" We live about fifty yards from the well we use, so we are really more fortunate than most people; but it is all up-hill, which makes water-carrying really hard work. It is not a job that women should have to do, but the man of the house cannot be expected to carry enough water for the household needs for the whole of the day. In the majority of cases he only comes home in the evenings, and even if he carries several buckets of water every night, the housewife still has to carry during the day. This is very tiring for an average healthy housewife, besides being inconvenient, but when we think of old people living alone, and people much less able-bodied than ourselves, it seems awful to think that every time they want any water, they must have someone else to carry it for them. It doesn't encourage people to keep themselves or their houses clean. A mother with tiny children has got to be carrying water all the while, because children must be bathed, and there are always clothes to be washed every day."

So wrote a member of a Women's Institute in a large village a few miles from Northampton in 1934.

I shall let the Women's Institutes continue my story. Here is an example from another village near Northampton :—

" We have one fresh water well and one soft water tank to supply eight houses. For months now it has been impossible to get a bucket of clean water fit for drinking. As there is only about one foot of water in the well, and as it has to be drawn up by means of a bucket and pole, the first bucket drawn in the morning is sufficient to stir it up to real muddiness. The mud has to be allowed to settle in the bucket, then the water boiled.

The well is situated about thirty-five yards from the house, and the path to it is by a row of five closets of the " pit " variety. The pit for four of these closets is only about five yards from the well mouth; it is supposed to be of brick and cement, and water-tight, but this is doubtful.

Two yards to one side of the well mouth are two refuse dumps for these houses. At the present time the dumps are overflowing.

The rainwater tank is underground, about eight yards from the house, the water also being obtained by means of a pole The rainwater from a block of four houses is collected in this tank and, as eight families draw from it, the supply in dry weather does not last long."

The next report is also from central Northamptonshire :—

" This family are quite 80 yards from the well. There is no means of getting the water home except by carrying in buckets : most of the children are called on to help to do this, some of the smaller ones using a milk-can or similar receptacle.

" Usually a bucket is got in overnight (unless the pump runs dry, then one has to wait until water runs in the well, and fetch some in the early morning) for the breakfast needs. The husband works some distance away, so leaves home at 6.40 a.m. ; this means the housewife rising early to prepare breakfast. . . . After this she attends to the two eldest boys, who go to work. One of them will probably fetch a bucket of water before going, so that there is enough for breakfast for the rest of the children, who now begin to make their needs known. If she has rainwater, she uses this to wash the children ready for school, and bath the baby. This water is caught in a tub from the spouting along the roof of the cottage. The washing-water will then be used for flushing the lavatory. Two more buckets must then be fetched from the well for washing-up, preparing and boiling vegetables, etc., for the midday meals and cleaning purposes. At least two more buckets are needed for tea. . . .

" The housewife has no sink ; all the washing-up, etc., is done on the table in the one living-room, which is also used for the washing. There being no copper, clothes have to be boiled in a large pot over the fire, which is awkward and rather unsafe, as the grates are so small."

This is from another village within a few miles of Wellingborough :—

" I am as economical as possible with the drinking water, using a minimum for cooking vegetables, and saving every drop I can : because my husband insists that carrying four gallons of drinking water uphill is a man's job—and it is a ticklish job telling a man to fetch four gallons of water uphill at the end of a hard day's work."

How much water, a hundred years ago, was needed in a town to keep a house and family reasonably clean ? A civil engineer who had investigated the matter carefully, reported that in London the actual consumption ot " the family of an English workman of the cleanest kind," consisting of five persons, was under twenty gallons a day. Ten were used for cooking and personal washing ; the other ten for washing the rooms, washing the linen, and watering the flowers.

In Northamptonshire to-day the following is an average sample of the quantities used by the village people :—

(1) Family of ten :—

Drinking, tea-making, and cooking	6 gallons.
Floor-cleaning	2 ,,
Washing-up	2 ,,
General household cleaning	2 ,,
Personal washing and bathing (afterwards used for flushing closets)	8 ,,
	20 ,,
Special requirements for washing day	20 ,,

(2) Family of four (two young children) :—

Drinking, and preparation of food	8 gallons.
Cleaning	4 ,,
Personal washing	8 ,,
	20 ,,
Clothes washing	24 ,,

(3) Family of five adults :—

Drinking, tea-making, and cooking	6 gallons.
Floor-washing and general cleaning (Owing to drought, this supply has previously to serve personal washing)	4 ,,
	10 ,,
Clothes washing	20 ,,

(4) Family of four :—

Drinking and tea-making	4 gallons.
Cooking, etc.	4 ,,
Personal washing and subsequently floor washing	8 ,,
	16 ,,
Clothes washing	24 ,,

Before we leave the actual evidence, it may be of interest to look more closely at the washing-day in a rural cottage :—

" I get up at 6.30, light the fire and get the breakfast ready for 7 o'clock ; then fill kettles and put on ready for washing-up and making starch. After washing up, and having no copper, I put the boiler on the fire. The nearest water is the brook about twenty yards away, but very seldom is it clean. If dirty, I have to fetch three buckets of water from the spring about forty yards away, with four steps down to it, to fill the boiler. While this is getting hot, I start washing, after fetching two more buckets of water for boiling the clothes in. Having a boil ready, I fetch two more buckets of water for rinsing. Having no drains, I have to take all dirty water back to the brook. When one lot is ready, I hang it out to dry. The lines are on the garden path, which is home-made—chiefly of ashes—and gets in an awful mess in wet weather. Also the rain dripping off the roofs on you, and no drains to take it away, makes your house in a terrible mess.

" So you go on till washing is done, fetching clean water from the spring and carrying dirty water back to the brook. You also have the risk, on an open fireplace, of soot and smoke from down the chimney.

" When finished washing and hanging out, I wash any dirty bowls, lamp glasses, baking tins, etc., in the washing water. Then I start to clean up, scrub the table, scrub the floor, put back the mats and get comfortable again after having made about thirty journeys with either clean or dirty water. If the weather keeps fine, towards night I fetch my clothes in and hang up in the home.

" I suppose my neighbours, having little children, have a lot more to do than me.

" It seems a nice place in the summer, with the willow trees by the brook ; but see it in winter, with the mud or floods up to your door. How nice it would be to have drains and water-taps, also somewhere to put ashes, empty tins, etc. It would be a big improvement."

The foregoing accounts are all from women to the manner born. The essays of townsfolk who have gone to live in the country are less complaisant. One extract will suffice : " I amused my townsfolk by telling them that I now economised with water and could be extravagant with milk."

If these are the everyday conditions in our villages, why is there so little articulate complaint ? The Chief Medical Officer, Sir John Simon, writing in 1890, gave an explanation which is substantially true to-day :—

" In regard to the less riotous forms of uncleanliness, far too much insensibility is widely shown.—See, for instance, how little fastidiousness prevails in the popular mind as to the domestic and commercial arrangements which supply *Drinking Water.*"

The old psychological attitude towards water as a free gift of Nature still prevails, but, even in villages, people are slowly beginning to realise that a good service of water is something worth while. They are becoming ready to make financial sacrifices to obtain good water. When a piped supply is available, a constantly increasing number of householders demand a direct connection to the mains. But convenience, rather than health, is the motive power. Apart from gross outbreaks of epidemic disease, it is hard to convince people that bad water has an injurious effect on health. The inhabitants of a village gradually become accustomed to their water supply, and live on tolerably good terms with the organisms which pollute it. Newcomers suffer for a time, but eventually become acclimatised. Yet the histories of water supply in Northamptonshire show that a considerable number of schemes owe their origin to a visitation of enteric fever. Water-borne disease is always waiting to strike unprotected communities, and it generally strikes hard.

It seems even more difficult to demonstrate that pure water is something more than a merely negative factor in health. An unrestricted supply of wholesome water brings to each house in its pipes positive well-being, convenience, comfort, and delight. It far surpasses electricity and gas, because the lack of these is not injurious to health.

If the drought of 1933-4 is now over—as I hope it is—there is a danger that smaller authorities may sink back with a sigh of relief into another decade of inactivity. Now is the time for action. Perhaps Nature will give us ten years' grace ; let us see what can be done in five.

The new world of a century ago, which was called into being by the industrial revolution, was concerned with the problem of learning how to live in towns. The new world of to-day is preoccupied with learning how to live in the country again. We bewail the exodus to the towns, and the depopulation of rural villages. But it is impossible to re-create village life on the old terms. A new generation is arising, and many of its members are eager to escape from town life ; but the village of the future must attract them by providing public services.

The village well has many beautiful traditions, although the parish pump is less happy in its associations. Both must be abandoned, if the new village community is to be a growing organism, with a life and an independence of its own. I believe that village communities can be saved from decay, but only subject to the condition that good houses, good water, and modern services are provided for the use of all.

In Northamptonshire, at any rate, pure and abundant water is the first and greatest need, in towns and villages alike ; let us hope that before long we may be able to join, without irony, in the prayer of St. Francis :—

> " Praised be my Lord for Sister Water,
> Who is very serviceable to us,
> And humble, and clean."

PART II.

SURVEY OF WATER SUPPLIES.

COUNTY BOROUGH OF NORTHAMPTON.

I am indebted to Mr. Knill, the Water Engineer and Manager, for the following account of Northampton Corporation Water Undertaking :—

General.

The Northampton Corporation are empowered by their Local Acts of Parliament to supply water and carry on their Water Undertaking within certain limits enclosing an area of 115.6 square miles in Northamptonshire. These limits extend to and include ; to the northwards the parishes of Old and Cottesbrooke ; to the east the parishes of Grendon and Doddington ; to the south the parishes of Stoke Bruerne, Tiffield and Greens Norton, and to the west the parishes of Flore and Whilton.

The population at present supplied is approximately 100,000, and the average daily consumption during the year 1933, when no restrictions were in force, was 2,300,000 gallons.

Sources of Supply.

RAVENSTHORPE RESERVOIR :

This reservoir impounds the waters of the Coton Brook and of other adjoining streams The raw water is passed through slow sand filters and the effluent is chlorinated. The whole of the water is pumped from Ravensthorpe into the Town service reservoirs.

Area of gathering ground	2,870 acres.
Total capacity of reservoir when full	414,000,000 gallons.
Top water level	348 O.D.
Total area of slow sand filters	7,400 square yards.

HOLLOWELL VALLEY INTAKE :

During times of water shortage, water is pumped from an intake in the Stowe Brook to a tunnel connecting the Hollowell Valley and the Ravensthorpe Works, where it is chlorinated. It flows along the tunnel and is repumped at the Ravensthorpe end into the Reservoir.

RAVENSTHORPE WELL :

This well is situated near the foot of the reservoir embankment. It is about 87 feet in depth and is sunk into the water-bearing marlstone of the Middle Lias.

The yield of this well is dependent on the rainfall and varies from about 300,000 to 150,000 gallons per day.

The water from this well is not filtered, but is chlorinated with the filtered water.

BILLING ROAD WELLS :

These two wells are at the Billing Road Works of the Corporation in Northampton, and they are 167 feet and 172 feet in depth respectively.

The yield from these Works varies from about 400,000 to 250,000 gallons per day. If the present deficiency of rain continues this latter figure may be less.

The water is chlorinated, before being pumped to supply.

EMERGENCY SUPPLIES :

At the end of 1933, in view of the possibility of a prolongation of the deficiency in the rainfall, the Corporation decided to construct works to collect the water in the gravel underlying the fields adjoining the River Nene between Boughton Crossing and Spratton Bridge. These works were authorised by the Northampton Corporation Act 1922.

Two pumping stations, at Boughton Crossing and Merry Tom respectively, were constructed. Each station consists of a battery of four pressure filters through which the raw water is pumped from the collecting well into the pure water tank. The raw water is treated with aluminium sulphate and sodium aluminate as a coagulant and is chlorinated. The filtered water is also chlorinated and then de-chlorinated with sulphur dioxide before being pumped to supply.

The total yield from these two sources is at present about 700,000 gallons per day.

A well is at present being sunk near Spratton Bridge to the water-bearing marlstone of the Middle Lias, and it is hoped that this will afford a permanent supplementary supply.

NON-DOMESTIC SUPPLY :

This supply is pumped from a shallow well sunk in the river gravel near Cattle Market Road, and the water is distributed by the non-domestic distribution pipes. A supply of water is thus available which, though impure, is of suitable quality for fire protection, street watering, sewer flushing and some trade purposes.

Distribution.

The water from Ravensthorpe and the various pumping stations is pumped into the Boughton and Tower Works service reservoirs, whence it flows into the high and low pressure supply zones respectively.

ADMINISTRATIVE COUNTY.

BOROUGH OF BRACKLEY.

Population (1931), 2,181. *No. of Houses*, 590.

The Brackley Town Council is the Authority for the undertaking which serves the Borough of Brackley, with the exception of outlying farm houses and cottages comprising the Hamlet of Halse.

The present undertaking was provided in the year 1879 at an initial cost of £8,200. Expenditure since that date on development has amounted to £3,800, which included a new deep well sunk in the year 1908 at a cost of about £2,050.

The following are the characters of the present supply :—

Source.

(*a*) GEOLOGICAL.

Soil	8 inches
Oolite	62 feet
Northampton Sand	13 ,,
Upper Lias Clay	102 ,,
Middle Lias	19 ,,
Lower Lias (bored from the bottom of the well) ...	36 ,,

(*b*) GENERAL.

The well is situated 470.11 O.D., and is 196 feet deep. The bore hole at the bottom continues for 36 feet. The well is of 6 feet diameter, and is lined with 9 inches of blue brick. There are key rings at 36 feet, 90 feet, 115 feet, 140 feet, and 165 feet. The bore hole is 10 inches in diameter.

The rest and pumping level is 3 feet. The average level during the past five years is 29 feet, the minimum (January, 1934) being 17 feet 3 inches. The average yield is 43,470 gallons per day.

Storage.

There are two reservoirs in the vicinity of the well. One, 468 O.D., has a capacity of 200,000 gallons, and the other, 561 O.D., has a capacity of 12,000 gallons. The former is built of brick and concrete and banked with earth, divided into three chambers by two walls to support the roof. It has ten manholes of brick with cast iron gratings in the top. The smaller reservoir is a cast iron tank built up of sections bolted together, and is used to supply water to the high part of the town.

Transmission.

Water is pumped from the well to the reservoirs by two reciprocating bucket and plunger lift pumps, single suction, double discharge. Each has a capacity of 8,000 gallons per hour. One is driven by a Crossley 20 B.H.P. Suction Gas Engine (gas produced at the Works from anthracite), belt and gearing. The other is driven by a 22 B.H.P. Tangye Crude Oil Engine, gearing only. The pumps and engines are not interchangeable.

The water gravitates from the service reservoirs to the mains.

Filtration is not found to be necessary.

Distribution.

There is a constant supply to a population of 2,200, 540 properties being served. 50 properties are supplied by 10 standpipes. There are 42 fire hydrants.

Adequacy of Supply.

The average quantities supplied per 24 hours are :—

Domestic	39,850 gallons
Trade, etc.	3,620 ,,
Total	43,470

During the last five years, the highest daily consumption was 61,828 gallons (four weeks ended 26th June, 1933) and the lowest 34,383 gallons (four weeks ended 26th August, 1930).

No deficiency has been encountered as a result of the drought of 1933. Although the level of water in the well has fallen, the supply has remained constant. There is probably a good margin of water available, but no pumping tests have been carried out.

The height of water in the well in the month of January during the past six years was as follows :—

1929	27 feet	0 inches
1930	34 ,,	0 ,,
1931	33 ,,	4 ,,
1932	33 ,,	0 ,,
1933	29 ,,	10 ,,
1934	17 ,,	3 ,,

Rainfall figures for the past five years are :—

1929	23.92 inches
1930	28.8 ,,
1931	25.31 ,,
1932	26.81 ,,
1933	17.45 ,,

Quality.

Organically this is a pure water, but decidedly saline. It contains nearly 80 grains per gallon of total solids, but is moderately soft.

Maintenance.

Outstanding loans at 31st March, 1933—£5,353. No separate water rate is levied in the Borough, water being supplied free for domestic purposes. Charges are made for water supplied for other than domestic purposes.

	£	s.	d.
Cost of working and maintenance for year ended 31-3-33 ...	575	14	8
Income for water supplied for other than domestic purposes	90	7	7
Deficit on the undertaking for year ended 31-3-33—made up from General Rate Fund	£1,325	0	0

There are still several private wells in the town. The Lynch Spring and Goldwell Spring have not failed in consequence of the recent drought.

BOROUGH OF DAVENTRY.

Population (1931), 3,609. *No. of houses*, 961.

Until the year 1903, Daventry was dependent on supply from a private company which was insufficient to include the smaller houses or to provide adequate flushing. This private supply still serves a small number of houses. The remainder of the town had to rely on public and private wells which gave an insufficient yield and were liable to pollution.

The Council investigated a number of sources of supply and finally chose the present scheme.

The present undertaking is owned by the Daventry Borough Council, with statutory rights over the whole area.

The existing water supply was installed in 1902-3 at an original cost of £7,532. The works constructed at that date were a well in the Parish of Dodford, with engine house, engines and pump, from where the water was pumped to a storage tank on Borough Hill, in the Borough, and thence gravitated through a 5-inch main to the houses in the town. In 1914 a water softening plant was installed beside the storage tank, between that tank and the pumping station, at a cost of £1,149. In 1931 an additional well was sunk close to the former well, at a cost of £942. In 1933 an additional storage tank was constructed close to the existing storage tank, with an 8-inch main feeding by gravitation to the town, at the opposite end to the 5-inch main, thus giving a supply from opposite ends. The cost of the second storage tank and 8-inch main was £3,210.

Prior to 1930 the water supply was adequate, but the town showed an increasing consumption, and with the dry summer of 1930 a very serious shortage occurred. To meet that difficulty, a second well was sunk and both wells connected by a heading, and since that date the supply has been adequate. At the present time, February, 1934, following upon the drought of last year, the level of the water in the well is considerably lower than at any time since the second well was constructed.

The quality of the supply has remained consistently good, except that it is very hard when it is pumped out of the well (30—36 degrees), but after treatment by the water-softening plant, the hardness is reduced to 8 or 9 degrees.

The Council are seeking further sources of supply to deal with the present emergency, and there is a likelihood that the remedy may be found in the drift gravels near Dodford.

Source.

The source of supply is a well, sunk to the marlstone, in the parish of Dodford, about two miles east of the town. The well stands at 393.00 O.D. and is 30 feet in depth. It is 7 feet in diameter and lined with brickwork. The rest level, in a normal year, is 388.33, and the average daily yield is 70,000 gallons.

Transmission.

The water is pumped from the well to service reservoirs by Diesel engines, 14 h.p., in duplicate, each capable of delivering 4,500 gallons per hour into service reservoirs.

There are two covered service reservoirs on Borough Hill, at elevations of 634.62 and 533.60 O.D. respectively. The total capacity is 350,000 gallons (top water level 639, draw off 627).

No filtration is necessary, but the water, which is somewhat hard, is softened by lime and soda.

Distribution.

No supplies are given in bulk. The town has a constant supply by gravitation. The population of the area is 3,608, and 3,500 are served. The total number of properties supplied from the service reservoir is 965. 92 properties depend either on the Water Company's service or on individual wells.

Adequacy of Supply.

The average quantity supplied per 24 hours is 70,000 to 80,000 gallons.

In January, 1934, the supply available was about 70,000 gallons per day, due to the lowering of the water in the water-bearing bed, owing to lack of rain. A sharp eye was kept to prevent waste. The water is of fairly good quality, but shows some traces of organic contamination.

Maintenance.

Outstanding loans amount to £4,696 3s. 6d.

	£	s.	d.
Maintenance cost, 1932-3	1,089	14	6
Loan repayments ,, ...	489	3	7
Water rents ,, ...	1,022	2	10
Deficit ,, ...	556	15	3

It is recognised, following upon expert advice, that the present source of supply has its limits, although having regard to the probable slow development of the Borough, it will probably prove adequate for the Borough for a few years. The fact that the water is at its present extremely low level after some years of drought, may well be taken to indicate that whilst the margin is, it is hoped, just safe in the present circumstances, should the consumption of water be greatly increased, an additional source of supply will have to be found.

BOROUGH OF HIGHAM FERRERS.

In 1899 the water supply of Higham Ferrers was obtained from surface wells, which were very liable to pollution. Local efforts to secure a satisfactory piped supply were uniformly unsuccessful.

In 1899 a Bill was promoted in Parliament for incorporating "The Nene Valley Waterworks Company" and empowering them to construct works in the parish of Little Addington, and serve a considerable area in Central Northamptonshire, including Higham Ferrers. Both Finedon and Higham Ferrers were in favour of the Bill, but it was opposed by most of the other Authorities in the area. The proceedings came to an end before a select committee of the House of Lords.

The next step was the incorporation of the Higham Ferrers Water Company by an Act which received the Royal Assent in June, 1900. This Act gave the Company power to construct a storage reservoir at Sywell, but at the end of two years no progress had been made. The Councils of Higham Ferrers and Rushden therefore decided to unite their forces and promote a Bill to constitute a Joint Water Board, vesting in them the powers of the Higham Ferrers Water Act, 1900 :—

"And whereas the Urban District Council of Rushden are the owners of the waterworks from which the inhabitants of their district are at present supplied but such supply is entirely inadequate and there is no public water supply in the borough of Higham Ferrers and it is of the highest importance to those places that the powers granted by the said Act should be carried into effect" . . . and so began the first co-ordinated scheme of water supply in the administrative County.

Details of the present scheme are given under the heading "Rushden."

BURTON LATIMER URBAN DISTRICT.

Population (1931), 3,587. *No. of houses*, 947.

The story of the public water supply in Burton Latimer starts about the year 1900. At that time, water was obtained by householders from local wells which were subject to serious variation in quality and quantity. It is stated that in August, 1902, 400 people relied on a well which had run dry before 6 a.m. every day ; water had to be carried long distances.

For several years, attempts were made to obtain a supply of water locally, but all of these schemes were inadequate. The difficulties encountered were such as have been met in several other parts of the County. The marlstone, which gives a good supply of water in some parts of the County, is missing at Burton Latimer, and the only water-bearing stratum present is the Ironstone. Attempts at boring were unsuccessful in obtaining an adequate quantity of water, and further attempts were frustrated by the opposition of mining interests.

The collection of surface water by the damming of a stream and formation of a reservoir was considered to be too costly, especially as the collecting area would of necessity be agricultural land, and therefore liable to pollution.

In 1905, these schemes for a local supply were dropped in favour of a scheme for purchasing from the Kettering Urban District Council their waterworks at Weekley, which had been constructed in 1871. These works included a well, pumping station, and caretaker's house.

This scheme came into force in 1906, and has been in operation ever since. In November, 1915, the supply was augmented from the mains of the Kettering U.D.C. owing to shortage from Weekley. This shortage was ascribed to the absence of any check on wastage and to leakage.

In July, 1921, the supply again became inadequate. Wells long disused were reopened, and the town supply was turned off daily at 5 p.m., and, later on, at midday. In the autumn of 1926, extensive leakages in the mains again caused a shortage, and the supply was augmented from the Kettering U.D.C. supply.

In common with many other towns, Burton Latimer has suffered severely as a result of the drought in 1933 and 1934.

The capital cost of the waterworks stands in the books of the Burton Latimer Urban District Council at £14,150, of which £6,681 will be outstanding at 31st March, 1934.

The well at Weekley, which is 30 feet deep, connects three underground shafts in surrounding grassland. The well is 6 feet in diameter and brick-lined. The water is obtained from Northamptonshire Sandstone. It is pumped from the well by an 8-inch rising main to the service reservoir in Warkton Lane, Warkton. The pumping plant consists of an A.C. Motor Drive of 20 h.p. (electric), connected by belt and shafting to either of a duplicate set of Mather's three throw pumps, each set capable of pumping 10,000 gallons an hour.

The Service Reservoir is of concrete faced with blue brick, and it has a capacity of 120,000 gallons.

The ground level at the Reservoir is 328 O.D., while the highest point served in Burton Latimer is 255 O.D. at ground level.

An analysis of the water showed it to be of a high degree of organic purity, but very hard. The water is not subjected to any form of filtration or chemical treatment. The Parish of Weekley is supplied free as a condition precedent to ownership, and the Parish of Warkton is supplied free to the extent of a maximum of 1200 gallons a day as a condition to the purchase of the site for the reservoir. The gravitation service main from the reservoir to Burton Latimer traverses one of the principal residential roads in Barton Seagrave, and by arrangement with Kettering Rural District Council a supply of approximately 135,000 a quarter is taken by that Council as a bulk supply.

The average supply available in normal times is about 62,000 gallons per 24 hours, but owing to the drought of 1933 it was only possible to pump approximately 35,000 gallons per day since December, 1933.

In 1926, an agreement was concluded with Kettering Urban District Council whereby in consideration of £25 per annum, they would, as occasion demanded, grant an auxiliary supply into the Burton Latimer mains which are connected with those of the Kettering U.D.C. This supply has amounted to about 12,000 gallons per day, at a cost of 2/- per 1,000 gallons, in addition to the above-mentioned annual payment.

The population of Burton Latimer is approximately 3,600 (3,587 in 1931 Census), while there are about 60 consumers in Barton Seagrave, and Weekley had a population of 241 (1931 Census), *i.e.*, there is a population of 3,900 consumers.

A population of 3,900 will consume nearly 60,000 gallons per day at 15 gallons per head per day, so that it is obvious that the Weekley source of supply is barely adequate in normal times, leaving no reserve for times of drought.

In August, 1934, the well at Weekley was producing only 26,000 gallons per day.

In 1934 the Council considered a number of sources for further supply ; their choice rested on a site close to the town, called Double-Dug Spinney, where a contractor estimated that a well, or wells, sunk would yield 1,000 gallons an hour. Various difficulties have arisen in connection with the scheme, and the matter is still unsettled. The estimated cost of the well was approximately £1,500.

DESBOROUGH URBAN DISTRICT.

Population (1931), 4,407. *No. of houses*, 1,163.

Until 1891, Desborough was one of the parishes of the Rural Sanitary Authority. It had no water supply or sewage disposal system, and outbreaks of epidemic disease were so common that " the place had become almost a byword." The first water scheme was introduced in 1895, the supply being derived from ironstone springs. The yield, estimated originally at 150,000 gallons a day, proved to be very variable, and in one year fell as low as 15,500. A serious shortage occurred in 1911, but the new scheme of 1912 relieved the situation until the drought of 1921. In this year another grave shortage led to an extension of the collecting drain and other improvements. Further extensions were made in 1931, but in spite of the energy and foresight of the Council, a water famine appeared once more on the horizon in 1933.

The Engineers investigated outside the area, and trial holes were made in respect of a supply from the Welland Valley, but without success. In the early months of 1934, welcome assistance was received from good neighbour Rothwell, but the water crisis continued to be acute.

In June a well was sunk at Pipewell and a good supply found (40,000 gallons per day). Boring operations were also carried out close to the existing source of supply. The cost of the works was estimated at £5,500.

The original works of the present undertaking were constructed from the design of Messrs. Everard and Pick, Civil Engineers, Leicester, and consisted of a pumping station at Braybrooke Road, containing a duplicate set of gas engines, 7 B.H.P. and pumps. A well 40 feet deep was sunk through the sandstone rock into the blue clay, and a 6-foot heading constructed. A service reservoir of a capacity of 156,000 gallons was constructed on a site close by. Water is pumped from the well to the service reservoir through an 8-inch rising main, and a 9-inch service main supplies the district. Service mains from 9 inches to 4 inches were laid in the various streets. These works were constructed during 1898-1900 at a cost of £10,039. Before 1912 it was evident that this supply (No. 1) could not be relied upon for any great quantity of water during a dry season. This may have been due to the working of the ironstone to the North-East of the well and the consequential diversion of the water. In 1912, a scheme to augment the supply was carried out. This consisted of a new pumping station (No. 2) at the Mill, Rushton Road, Desborough, with a 22 B.H.P. oil engine and pump, and a storage tank of 50,000 gallons capacity. A collecting drain was laid, to which various springs were connected and conducted to the tank, water being pumped direct to the mains. The cost of this work was £4,430. In 1922, it was decided to extend the collecting drain at the No. 2 works; also to duplicate the oil engine and pump and instal a "Bell" high pressure filter. This work was carried out in 1923-4 at a cost of £2,300. In 1931, a scheme for the relief of unemployment, and consisting of a further extension of the collecting drain at No. 2 works in Rushton Road, and the provision of a second "Bell" pressure filter, was sanctioned, and the work carried out in 1932 at a cost of £1,328.

The total cost to date is :—

	£
No. 1 Works	10,039
No. 2 Works	8,058
	£18,097

During period of drought the supply has been inadequate. The above descriptions of the various extensions made give the particulars taken to remedy the defect.

Generally the water has been of good quality.

Source.

The Source of No. 1 Supply is as follows :—

Geological strata—Northamptonshire Sandstone.
Ground level of well—453 feet.
Depth—40 feet.
Diameter and lining of well—9-foot blue brick.
Rest level—9 feet.
Average and minimum (January, 1934) yields of each source per 24 hours—

No. 1 Works	2,000 gallons.
No. 2 Works	43,000 ,,

Storage.

There is no impounding reservoir for storage.

The Service Reservoir is covered brick and concrete, in Braybrooke Road, Desborough, attached to No. 1 works; elevation 468 feet. A short length of Harborough Road can obtain water only during the hours of pumping. The capacity of service reservoir is 156,000 gallons; top water level 468 feet; standpipe 498 feet.

Filtration is carried out as a precautionary measure, with "Bell" high pressure filter. There are two filters of 8 feet diameter, and the maximum rate of filtration is 10,000 gallons per hour. The coagulant used is Sulphate of Ammonia.

Distribution.

Distribution is by pumping and gravitation, and is constant under normal conditions. The population is 4,407 (Census, 1931). All properties are supplied from the service reservoir, estimated as follows :—

Supplied—1,227.
Not supplied—13 farms, etc., in outlying parts of the district.
Supplied by standpipes—301.

There are 75 standpipes and 66 fire hydrants.

The average quantity supplied in gallons per 24 hours is 56,000 gallons for domestic purposes and 11,000 gallons for trade purposes. The total supply available during January, 1934, was

45,000 gallons from all sources, this being 23,000 gallons less than the normal consumption. Investigations have been made by Messrs. Pick, Everard, Keay and Gimson, Civil Engineers, Leicester, for any available supply that could be utilised during the emergency, but no further supplies could be located in the district. Recent analysis shows that the water is of good quality.

Maintenance.

The amount of loans outstanding is £3,816. The present cost of maintenance is :—

	£
Working expenses	894
Loan repayments	436
	£1,330

No separate charge is made for water for domestic purposes, the only charge being for trade, garages, etc. The net cost of water supply is included in the General Rate, and including loan repayments is equal to 1/6¾ in the £.

FINEDON URBAN DISTRICT.

Population (1931), 4,100. *No. of houses*, 1,007.

The Finedon Council began to face their water problem in the year 1894, when a well was sunk near the Burton Latimer Road. The yield from this well was not sufficient for the needs of the district, and the well was abandoned for many years.

In 1900 the Council made application for a loan of £1,000 for experimental boring ; at that time their supply was entirely from shallow wells, many of which were polluted and failed in dry weather.

In 1901 an abundant supply of over 100,000 gallons a day was struck in the marlstone—the water proved to be highly mineralised, containing 104 grains per gallon of salt and total solids amounting to 153 grains per gallon ; the hardness of the water was only 3¾°. The cost of this preliminary sinking was approximately £200.

The following are the particulars of the present undertaking :—

The authority for supply is the Urban District Council of Finedon acting under the Finedon Urban District Water Act, 1902. The area of supply is the Urban District of Finedon.

The present water supply is derived from a well sunk about 1905 near the Wellingborough Road, about a mile south of the town. Loans amounting to £15,270 were raised during the years 1901 to 1905 for the purpose of sinking wells, purchase of lands, construction of water works, laying of mains and other incidental expenditure. In 1923 £400 was raised by loan for the purpose of installing auxiliary plant at the water works.

The water supply has not been adequate in the past ; the supply yielded by the well has gradually diminished. Extra pumping was tried and was partially successful, but the supply continued to diminish.

In 1934 the Consulting Engineers prepared plans for a scheme of water supply from wells in the valley gravels of the Nene between Ditchford and Rushden. The yield from a single well was over 100,000 gallons a day. The estimated cost of the scheme, including a long pumping main to the tower, was £10,600, and it is calculated that the maintenance costs would be approximately £270 a year.

A supply of water from Irthlingborough was also considered, and the payment suggested was at a rate of 9d. per 1,000 gallons, amounting to £1,095 for a service of 80,000 gallons per day. In addition, the capital cost of new pumping machinery, extensions to the well, new rising main, etc., was estimated at £5,000. Neither of these schemes has been approved, and at the present time Finedon relies on a temporary supply from the Burton Road well; the water from this supply is chlorinated and regular analyses are carried out.

Source.

The existing well is 137 feet deep and 7 feet in diameter, lined throughout with red brickwork in cement.

The geological strata in the Finedon District, in descending order, are as follows :—

1. Great Oolite.
2. Estuarine Beds.
3. Northampton Sand (Ironstone).
4. Upper Lias Clay.
5. Middle Lias Clay.

The present supply comes from the middle lias (Marlstone Rock).

No test has been made as to the average and minimum yield of the well each 24 hours, since the water is now pumped immediately it is available.

Transmission.

Pumping is by means of two bucket pumps driven by a Gas Engine and an Oil Engine 41 h.p. The Gas Engine was installed in or about 1903 and the Oil Engine in 1923. The rate of discharge of the pumps is about five to six thousand gallons per hour. The water is pumped up to an elevated tank; the main through which water is pumped passes through the town and acts also as a service main.

The service reservoir is a steel tank, 30 feet in diameter and 19½ feet deep, erected in a tower situate on the Irthlingborough Road, south-east of the town. The top water level is 80 feet above ground and the town is supplied by gravitation. The ground level of the tower is 300 feet above sea level. The capacity of the tank is now about 75,000 gallons; a layer of concrete was placed over the steel floor some time ago to protect the floor.

Filtration is not considered necessary; analyses show the water to be pure.

Distribution.

A constant supply is made by gravitation. The population of the statutory area, according to the census in 1931, is 4,100. All properties are supplied from the service reservoir with the exception of those supplied by the rising main which also in certain parts is used for supply purposes.

The number of properties supplied is 1,024. About 500 houses are supplied by standpipes and not individually. The number of standpipes for domestic supply is 84. The number of fire hydrants is 30.

The average quantity supplied every 24 hours is 65,000 gallons :—

For domestic supply	49,000 gallons.
Trade purposes	15,000 ,,
Other purposes	1,000 ,,

The supply in January, 1933, was uncertain. There was a deficient supply during that summer, and water from a well had to be carted round the town.

Maintenance.

The outstanding debt amounts to £9,746 12s. 8d. The average annual cost for the last five years is £1,320 4s. 5d. This expenditure is abnormal. The scarcity of water has involved the employment of additional labour for pumping, and consequently the extra pumping has resulted in an increase in the cost of running the plant. Large sums have been expended in the last three years on repairs to the plant. Water charges are based on rateable value. The present return from water rates is about £800.

The water undertaking has never shown a profit. The deficit each year is borne by general rates ; the average annual loss for the last five years is £516 4s. 7d.

There is a spring known as the Dolben Square well situate in the centre of the town. The water is not fit for human consumption, but has been used to supplement the main supply.

Twenty-eight properties have private wells (six pumps). The wells could be utilised if necessity arose. They were discontinued when the Public Water Supply was inaugurated, and have not since been used.

IRTHLINGBOROUGH URBAN DISTRICT.

Population (1931), 4,715. *No. of houses*, 1,208.

The first well for public supply at Irthlingborough was sunk in the year 1900, and the works were completed in 1905. Up to the year 1908 loans for providing a public water supply had been sanctioned and raised to the amount of £11,150.

The supply was first turned on in 1905, and was adequate in quantity until 1907, when a serious diminution began to set in. A new well was sunk in the Parish Field at a cost of £579, but even this supplement proved to be insufficient. The Council accordingly determined to sink a deeper well to reach the marlstone at an estimated cost of £800.

This boring was sunk from the bottom of an old ironstone cutting to about 120 feet in the upper lias clay, and then abandoned. I understand that it was subsequently carried down by a private firm to 150 feet, but the water found was quite unsuitable for domestic purposes.

In 1909 the position of the water supply was so serious that the Rushden and Higham Ferrers Water Board were approached, and it was even suggested that assistance might be obtained from Finedon. These tentative arrangements did not materialise, and in 1910 the Council purchased their present site.

The first well was 90 feet deep, the top 10 feet being brick-lined, the rest of the well being unlined passing through ironstone. The second well was 40 feet deep and was unlined, passing through ironstone.

The subsidiary scheme adjoining the Wellingborough Road was under consideration by the Council in 1906, when the Surveyor was given instructions to open up a trial hole (December, 1906). Up to June, 1907, contracts for this scheme had been let for the supply of an engine and engine house, and in December, 1907, it was decided to sink the well through the lias clay to the marlstone. The water question was so serious that in November, 1907, supplies for trade purposes were discontinued.

The Irthlingborough Urban District Council is the Authority (Non-Statutory) for the present undertaking.

The present supply was installed as a result of the failure of the previous schemes outlined above. The well and engine house are situated in the eastern corner of field No. 254 (Ordnance Survey Sheet XXXIII. 13, Northants.). The mains and service reservoir of the first scheme are utilised in this service. The supply has always been adequate since the inception of the scheme in October, 1910, and there has never been any shortage. The cost (paid out of revenue) was approximately £522.

Source.

(*a*) Geological. The ground level is at 116 O.D., and the bottom of the well is at 100.65 O.D., giving a depth of 15.35 feet. It pierces 9 inches of surface soil, 3 feet 6 inches to 4 feet 10 inches of marly clay, and 10 to 11 feet of drift gravel.

(*b*) General. The diameter of the well is 6 feet, and it is lined with three cast iron sections each five feet in depth, the lowest section being perforated. Topping the cast iron portion is a concrete surround level with the engine house floor at 118.23 O.D. ; this concrete penetrates the marly clay.

Normal level is about 111.73 O.D., but this varies throughout the year and water sometimes comes up to a depth of 13 to 14 feet in the well. Pumping level falls from 111.73 O.D. to 107.06 O.D. after a normal day's pumping of 10 hours.

During the drought of 1934, the lowest level experienced at the commencement of pumping was 109.95 O.D., and after 12½ hours' pumping this was reduced to 104.65 O.D.

Commencing pumping at 7 a.m. on Tuesday, 5th June, 1934, a 36-hours' pumping test was carried out. At commencement of pumping the depth of water in the well was 10 feet ; at termination of pumping at 7 p.m. on Wednesday, 6th June, the level had been reduced to 4 feet 1 inch, and by 7 a.m. on Thursday, 7th June (commencement of another day's pumping), the level in the well was up to 9 feet 8 inches.

No records are available to give the average or minimum yield. The maximum fall in level of water in the well occurs up to two hours' pumping, after which the level remains fairly constant throughout the pumping day, and no appreciable difference has ever been observed. On cessation of pumping, the water returns almost to its original level in about two hours.

The maximum quantity pumped per hour is 13,000 gallons, and the minimum on a full pumping day of 10 hours is 10,000 gallons per hour, as recorded by Venturi meter recently installed.

There is no impounding reservoir.

Service.

The service reservoir is of mass concrete construction with a central dividing wall. The main walls are lined with blue vitreous bricks backed with bitumen, and the whole covered with reinforced concrete ; the bottom of the reservoir is approximately 5 feet below the level of the adjoining ground, and the sides are banked up with earth and the top covered with about 1 foot of earth.

The reservoir is situated 450 yards north-west of the town up Windmill Road and near the Cricket Field. The ground level of the reservoir is 276.03 O.D., and the highest point served is in Finedon Road and the level in the road is 267.37 O.D. ; so far as can be ascertained, the highest fitting served is at 267.95 O.D.

The capacity of the reservoir is 690,000 gallons. Top water level 284.93 O.D. ; bottom water level 271.68 O.D.

Filtration is not considered necessary.

Distribution.

There are no bulk supplies at present, but an agreement has been made to provide the new laundry with from 40,000 to 80,000 gallons a day.

The town is fed directly off the pumping main ; unconsumed water passes into the service reservoir and gravitates to feed the town during non-pumping hours. Pumping hours are as follows :—

Monday	6 a.m. to 5 p.m.	11 hours.
Tuesday to Friday	7 a.m. to 5 p.m.	10 ,,
Saturday	7 a.m. to 12 noon	5 ,,
Sunday morning		2 ,,

with such additional pumping as is found necessary to keep the reservoir full.

There is a constant supply to a population of 4,715 (1931 Census), 4,679 (1933 estimated), and 4,649 are actually served. The total properties supplied are 1,170, and 59 houses and farms are supplied from wells. 497 premises are served by standpipes and not individually. There are 114 standpipes for domestic supply, and 56 fire hydrants.

Supply.

The following are the figures for six months ended 30th June, 1934.

Domestic supply	59,011	gallons per day.
Trade supply	32,762	,, ,, ,,
Other purposes	3,282	,, ,, ,,
Average total ...	95,055	,, ,, ,,

The limit of the quantity of water available has never been ascertained. There has never been any shortage, the supply always having been quite capable of meeting the demand.

Quality.

The water is extremely hard (36°—42°), but otherwise is satisfactory for general use. It is interesting to note that the hardness varies from time to time : this is apparently due to differences in the relative proportions of gravel water and inflow from springs issuing from the base of the ironstone. There are generally traces of organic contamination, but this appears to be largely of vegetable origin. No valley gravel supply can be considered as entirely safe.

Maintenance.

On 31st March, 1934, £1,158 8s. 9d. was owing on loans.

	£	s.	d.
Working expenses for year ended 31-3-33	751	2	10
Loan charges for year ended 31-3-33	163	10	8
	£914	13	6
Total income from water undertaking for year ended 31-3-33	£1,429	19	11
Balance, in aid of rates, for year ended 31-3-33	£515	6	5

59 properties are supplied by 21 shallow private wells, which derive their water from limestone and ironstone. The water is raised by suction pumps.

None of these wells failed in 1933, but two failed in 1934.

KETTERING URBAN DISTRICT.

Population (1931), 31,220. *No. of houses*, 7,691.

The original supply of the district was an ironstone well at Weekley—subsequently purchased by Burton Latimer. In 1899 the Council purchased the waterworks of the Kettering Water Company at a total cost of £148,111. Under the Kettering Water Act, 1901, the Council obtained powers to construct a reservoir in the Orton Valley ; these powers were not exercised, and lapsed in 1906. Meanwhile the original Cransley Reservoir could no longer satisfy the needs of a growing and prosperous town, and it was decided to construct a new impounding reservoir at Thorpe Malsor. This scheme proved to be difficult and expensive, owing to subsidences during construction, but the reservoir was finally completed in 1904 at a cost of £61,000.

The present undertaking is owned by the Kettering Urban District Council. The Statutory area of supply is the Urban District, and a supplementary service is given to Burton Latimer Urban District Council by agreement.

The water supply has been sufficient up to the present time, although at one period in 1914 only 46,000,000 gallons were available. In 1921 only 53,000,000 gallons were available.

During the present drought the maximum available is approximately 66,000,000 gallons.

In 1921 the full supply was curtailed : during the present drought the supply has also been curtailed.

At present, alternative temporary supplies are being considered, but difficulty is being experienced in obtaining water in sufficient quantity.

Source.

The sources of supply are streams in the Cransley and Loddington valleys, both of which are gently undulating gathering grounds of the oolite formation, with superimposed clays of the upper estuarine series, and Northamptonshire sand with lower estuarine series below. The two impounding reservoirs are constructed in the upper lias clay. The gathering ground is fairly flat.

The depth of the well at Clover Hill is 75 feet, 6 feet in diameter, with brickwork lining. The present pumping level is 7 feet above bottom, present rest level 6 feet and normal pumping level 15 feet above bottom.

The normal average yields are :—

Cransley	581,932 gallons per 24 hours.
Thorpe	396,814 ,, ,, 24 ,,
Well	70,000 ,, ,, 24 ,,

At the present time the average yields are :—

Cransley	180,000 gallons per 24 hours.
Thorpe	43,000 ,, ,, 24 ,,
Well	21 to 25,000 ,, ,, 24 ,,

The Cransley Reservoir was constructed in 1884. It is situated at approximately 2½ to 2¾ miles to the eastern boundary of the gathering grounds.

Total capacity	160,000,000 gallons.
Effective capacity	145,000,000 gallons (approx.).
Level of sill overflow	297.52 O.D.
Level of lowest point of reservoir	269.77 O.D.

The area of water surface when full is 50 acres, and the area of gathering ground 1,805 acres.

Thorpe Malsor Reservoir was constructed in 1904, approximately three miles to the east of the gathering grounds.

Total capacity	130,000,000 gallons.
Effective capacity	122,000,000 gallons.
Level of sill overflow	334.31 O.D.
Level of lowest point of reservoir	282.81 O.D.

The area of gathering grounds is 1,330 acres, and the area of water surface when full, 31.6 acres.

Thorpe gravitates by 15-inch C.I. mains to Cransley. From impounding reservoir to service reservoir by pumping with two centrifugal electrically-driven pumps capable of delivering 60,000 gallons per hour, with one petrol-driven centrifugal pump as stand-by capable of delivering 42,000 gallons per hour. There are two service reservoirs, one of brickwork and part reinforced concrete, and one reinforced concrete. The capacity of the service reservoir is approximately 1½ million gallons. There is also a cast iron tank on top of the pump house for emergency pressure, which can be fed either from the pumps or from the Council's mains, capacity, 42,000 gallons. The reservoir is situated at the northern end of the town on the high ground, but the elevation is not material, since the highest points of the town are served under pressure from pumps. The water level is 339 O.D. The town supply is filtered at the Cransley works on the slow sand filtration method. There are five filters serving a total area of 2,500 square yards, and the maximum rate of filtration is 13,500 gallons per filter, per hour. The average quantity filtered is 868,000 gallons per day; the filtration media are 2 feet of sand on 1-inch granite chippings.

Distribution.

Electricity Works, L.M.S. Railway, Baths, April to October. Burton Latimer Urban District Council when called upon to do so. During the present drought 20,000 gallons per day are being supplied to Burton Latimer. Thorpe Malsor village, a perpetual supply of 28,000 gallons per week (in accordance with Clause in Water Act).

The distribution by pumping is at the rate of 60,000 gallons per hour, with duplicate pumping plant similar to plant at the impounding reservoir.

One 12 h.p. well pump capable of delivering 6,000 gallons per hour into reservoir for distribution.

The statutory area is 2,814 acres, serving a population of 32,500 ; Thorpe Malsor Estate is also supplied. A stand-by supply to Burton Latimer—population, 3,587. All properties are supplied from service mains fed from service reservoirs. The cattle troughs, etc., are fed from pumping main.

Total properties supplied—approximately 8,550 ; not supplied—approximately 450 properties. A few houses supplied by standpipes in private courts. There are some 900 fire hydrants.

Adequacy of Supply.

Domestic	Approximately	652,000	gallons.
Trade	,,	156,000	,,
Other purposes	,,	27,000	,,

At the end of January there was approximately ten weeks' supply in the impounding reservoir. As a result of the continued drought, the reservoirs have not filled up as was expected, and are still being depleted, and the streams feeding the reservoirs are gradually diminishing. In order to conserve the supply, the water has been cut off daily during the month of January from 8 p.m. to 6.30 a.m. During February the supply has been further curtailed from 5 p.m. to 6.30 a.m. The water is of good quality, both chemically and bacteriologically, and the total hardness is only 10.4° (9.0° permanent).

The consideration of supplementary supplies is under consideration by the Council, and the advice of the Ministry of Health is being sought.

There are no public wells, but the town has been circularised to ascertain the number of private wells, which water would be available for purposes other than drinking and cooking.

There are 459 private wells. The prevailing type of well is of the shallow type, with the exception of one at the Kettering Dairy which is reputed to be over 100 feet deep. The strata is ironstone on clay, and the usual type of suction pump is used for drawing water. Many of the wells failed in 1921, and have failed again this year. Several wells are known to have provided moderate supplies, but have not been used until the early part of this year.

A summary of replies to a questionnaire which was sent out to owners of wells is given below :—

	Replies from Owners.	*No. of wells.*
Drinking Water	393	422
Wells or Springs which might prove to be drinking water on inspection	366	437
Soft Water Wells or Springs	340	
Rain Water Cisterns	301	
" Nil " Returns	1,900	
	3,300	

Percentage of Replies received : 74%.

	No. of Wells.	
	In use.	*Not in use.*
Drinking Water	314	108
Wells or Springs which might prove to be drinking water on inspection	80	357

Expenditure.

The approximate expenditure, including interest and instalments of loans and sinking fund contributions for the year 1933-4 was £24,785, and the total income £24,081. The nett expenditure required from the rate was £315, after allowing for surplus from the previous year.

Steps taken to improve Supplies.

CRANSLEY RESERVOIR. In 1929, 25,000 cubic yards of silt were taken from the neck of Cransley reservoir ; during this winter a further 12,571 cubic yards have been taken out. The springs feeding Cransley reservoir have been opened out, re-piped, the water courses cleared and the main stream freed from all obstructions.

THORPE RESERVOIR. At present further dredging work is in active progress at Thorpe Reservoir.

Emergency Water Supply.

The Council's Surveyor reported as follows :—

The immediate countryside has been thoroughly explored, the streams and springs examined in order to find a sufficient supply of water. The most suitable source of supply, in any quantity, was found to be the River Ise, near Harrington, in the Kettering Rural District Council Area, where water in sufficient quantity can be abstracted at a point approximately 800 yards west of Newbottle bridge.

The River Ise, which has a drainage area of over 10,000 acres, rises seven miles west of Kettering, and is fed by two streams, one tributary rising to the west of Naseby, and the other to the south-west of Clipston, in the Oxendon Rural District Council Area.

The gathering grounds of the Ise are of the upper lias clay formation, the main feeder of the river being the Clipston tributary.

The Naseby stream and the Clipston stream unite in close proximity to the village of Arthingworth, whence the river flows for a distance of about two miles in an easterly direction to the site of the intake, approximately 800 yards west of Newbottle bridge, after which the river flows in an easterly direction for about seven miles, and then takes a southerly course at Geddington, and continues to flow in a southerly direction until it joins the River Nene at Wellingborough.

It is stated that the gathering ground is capable of yielding approximately 3,000,000 gallons per day in normal weather.

The whole of the watershed area consists almost entirely of pasture land, grazed principally by sheep, there being no arable land in close proximity to the River Ise. The meadows in close proximity to the river are subject to flood conditions.

The area is sparsely populated, and the only villages up-stream of the proposed intake are those of Arthingworth, Kelmarsh and Clipston.

Land. It is proposed to acquire approximately 8½ acres of land, 4.16 acres being on the north side of the river, and 4.383 acres on the south side, and also to straighten the brook.

Pump House. The pump house is constructed on the south side of the river, with a small section well ; water to be conveyed along a concrete channel, provision being made in the channel for a screen to be fixed.

Pumps. It is proposed to instal a two-stage medium-lift centrifugal pump, capable of delivering 1,000 gallons of reasonably clean water per minute, against a total head from all causes of 300 feet. The pump to run at the speed of about 1,500 revolutions per minute, and to be driven by an A.C. motor, 135 B.H.P.

Electricity. Electricity will be available on the site, alternating current, 400 volts, 50-cycle, 3-phase. A Venturi meter to be provided on the rising 12-inch main.

Main, Size, etc. Size of pump main, 12 inches. Length of pump main, 5,360 yards. This will be laid with 3 feet of cover in the verge along the Harrington—Loddington Road.

Route of Main. It is not proposed to lay the main along the entire length of the valley to Thorpe reservoir, but to discharge at the head of the stream feeding the Thorpe reservoir, from whence the water will flow in the existing open channel for a distance of approximately 1¾ miles into the reservoir. The water will then gravitate from Thorpe reservoir through the 15-inch main to Cransley reservoir, where the existing slow sand filters and pumping plant are installed.

Additional Filtration Plant. The Council's Consultant reports that additional purification works are necessary, and it is therefore proposed to provide pressure sand filters at a filtration rate not exceeding 80 gallons per square foot per hour, with facilities for a preliminary dosing of the water with chalk and alumina sulphate added to the crude reservoir water as discharged through pressure filters. Capacity of plant, 60,000 gallons per hour. After pre-filtration the water will be treated through the existing slow sand filters at an increased rate. The water will finally be sterilised by means of chloramine.

Filter House. The filters to be housed in a new filter house, and provision made at Cransley reservoir for the installation of a lagoon for the clarification and disposal of the water used for washing the pressure filters."

In addition to the above, the Council sought an emergency supply of water from Mawsley Wood, and for a time, at any rate, a considerable amount was pumped from there to the existing reservoirs. The Mawsley workings were only a short distance from the streams which feed the Cransley Reservoir.

The failure of the main reservoirs had become so serious in 1934, owing to the continued drought, that it became necessary for the Council to seek a further emergency supply, especially as the River Ise at Harrington was not yielding the quantities which had been anticipated. It was, therefore, decided to lay overland a main from the Wicksteed Park Lake and connect it to the pumping station at Clover Hill ; this supply served to tide Kettering over the worst period of water shortage, and large quantities have been pumped from the lake without any serious diminution of its level.

OUNDLE URBAN DISTRICT.

Population (1931), 2,001. *No. of houses*, 528.

The present undertaking of the Urban District Council serves an area of 2,075 acres (Statutory). The initial cost of the scheme was £7,000, and an extension has since been made at a cost of £1,000. The supply of water has been adequate at all times. Its quality has been known to fall below standard, but not during the past seven years since the ground has been raised above flood level.

Source.

The gathering ground is the Nene Watershed. A well is sunk to the gravel at a depth of 22 feet, with a diameter of 10 feet, and is brick-lined and puddled. In March, 1934, the rest level was 12 feet, and the pumping level 3 feet 6 inches. The normal rest level is 13 feet 11 inches. Pumping is continuous until the reservoir is filled daily. The yield per 24 hours is 160,000 gallons.

Storage.

There is no storage reservoir, only a balancing tank, capacity 70,000 gallons, situated 1½ miles from the Pumping Station. The top level is 221 O.D., draw-off level 211 O.D. This is of brick construction, covered in. The highest point served is 151 O.D.

Transmission.

Transmission from source to impounding reservoir is by set of three throw pumps (modern), with a capacity of 11,000 gallons per hour, and one set of three throw pumps (old but effective), with a capacity of 7,000 gallons per hour. Pumping is by Crossley Engines, Crude Oil, H.P. 35 to 39. The size of trunk main is 6 inches. There are two centrifugal pumps which lift the water from the well to the filter beds.

Filtration is carried out as a precautionary measure. The present filters (sand) merely act as strainers, and the filtration or straining takes place only when pumping operations are taking place. There are two filters, each 30 feet by 26 feet, and the maximum rate of filtration is 27 feet in 24 hours. The average quantity filtered is 90,000 gallons per day. No coagulants are used.

Distribution.

Distribution is by pumping during pumping hours and gravitation after pumping has ceased ; this is constant. The population of the Statutory area is 2,789, and the number supplied 2,625. All properties are not supplied from service reservoir. There are about 14 private wells in the area which give an ample supply, and several properties are situated a long distance from the mains. The estimated number of properties supplied is 611, and the number not supplied, having wells or being too far from mains, is 43. The number supplied by standpipes and not service to individual houses is 178. There are 52 standpipes for domestic supply, and 55 fire hydrants. The average quantity supplied in gallons per 24 hours for all purposes is 90,000. The actual supply available in January, 1934, was approximately 190,000 gallons in 24 hours.

In 1923 there was a small outbreak of sickness which was apparently water-borne. The Medical Officer felt that this might be due to the entry of flood water to the well, and measures were taken to prevent this in future. Recent analysis shows that the water is of good quality, wholesome for drinking and domestic purposes, although somewhat hard.

Maintenance.

Outstanding Capital Loans amount to £597. The present cost of working and maintenance is £1,203. The actual water rate is 10d. in the £, which gives a return of £1,223 and a profit of £20.

Private Supplies.

There are 43 properties which are dependent for supplies from private wells. The wells are mostly shallow—rock and gravel—and the ordinary type of pump is used for drawing water except where it is drawn by chain and bucket. During an average year the supply is adequate, and no wells have failed.

RAUNDS URBAN DISTRICT.

Population (1931), 3,683. *No. of houses*, 985.

An agreement was suggested in 1900 for a supply of water to Raunds under the statutory powers of the Higham Ferrers Water Act. The cost of a bulk supply was to be 6d. to 9d. per 1,000 gallons at not less than 140,000 nor more than 600,000 gallons per week. Meantime, possible local sources were investigated and an experimental boring was made at Pasture Lodge Farm. Various wells in the town were tested and found wanting.

The town suffered severely from water shortage in the years 1903-05, and the Council decided to borrow £500 to undertake the sinking of a well to the marlstone. The well in Meadow Road was a heart-breaking task, owing to an enormous inrush of water from the valley gravel. Meanwhile the £500 had been spent, and it was decided to borrow a further £250 to continue the operations. At 115 feet the contractors suspended operations and later became bankrupt. The Council's engineer continued the work under great difficulties, and ultimately reached the marlstone at 130 feet. This long-sought stratum was found to consist of 6 inches of chalky concretions, and 1 foot 9 inches of ironstone nodules embedded in clay—containing salt water! A boring was carried down a further 12 feet in the blue clay and then abandoned.

It was decided to make use of the valley gravels, and a scheme was brought forward at an estimated cost of £8,500. The scheme was completed in 1909.

The authority for the supply is statutory, and the area of supply is the Urban District of Raunds. The initial cost of the present undertaking was £8,358, cost of additional well £900, extension and cost of development of additional well in 1929, £2,650, and cost of new engine £350, making a total expenditure of £12,258. The supply of water has been adequate.

Source.

The whole supply is drawn from four wells (A, B, C and D), sunk into Valley Gravels alongside the River Nene. The water-bearing gravels lie between bands of clay, and at A. occur about 11 feet below the surface of the ground and are about 11 feet thick. At D. the gravel is about 9 feet thick and about 8 feet below the surface. The Middle Lias Clay containing the Marlstone Rock bed occurs at about 120 feet, and the well sunk into the marlstone in 1906 was refilled to its present depth. This well is now used as the main pumping well.

The following list shows particulars of the four wells :—

Well.	*Diameter.*	*Depth.*	*Lining.*	*Sunk.*
A.	10 feet.	18 feet.	Iron Cylinders.	1906.
B.	16 feet.	18 feet.	do.	1921.
C.	6 feet.	16 feet.	Brick.	1908.
D.	16 feet.	22 feet.	Iron Cylinders.	1929.

The Pumping Station is on the site of the three wells, A., B. and C., and the pump suction is connected to well A. Well C. is connected by siphon to Well B. Well B. is connected 3 feet above its floor to Well A. Well D. is connected to Well A., water being pumped into a 6-inch cast iron main gravitating to Well A. Wells A., B. and C. are distant from the River Nene about 2,000 feet. Well D. is distant from the River Nene about 900 feet. Well D. is distant from Well A. about 1,400 feet.

The rest level of main pumping Well A. is usually regarded as 7 feet, but now varies between 7 feet 6 inches and 8 feet. The Rest Level of new Well D. is usually regarded as 12 feet, but is now (March, 1934) constant at 14 feet. The levels after pumping are—Main Well A., 3 feet 6 inches ; new Well D., 6 feet.

Pumping tests have not been made, but wells have been lowered and refilling timed with the following results :—

	Oct. 12/33.	*Dec.* 2/33.	*Feb.* 12/34.	*Mar.* 7/34.
Well D. refilled at rate of	104,000	124,300	133,000	136,000
Well A. (includes B. & C.)	22,000	18,700	20,000	34,000
Gallons per day	126,000	143,000	153,000	170,000

Storage.

There is no Impounding Reservoir.

Transmission.

This is by pumping plant which delivers water from the main pumping well A. into the Service Reservoir, and consists of :—one 30 h.p. Ruston Diesel Oil Engine, installed in 1931, one 26 h.p. Suction Gas Engine, installed in 1908 (now used as a stand-by), duplicate sets of three throw ram pumps, displacing approximately 9,500 gallons per hour against a total head of 217 feet including friction when driven by the oil engine, and approximately 8,000 gallons per hour when driven by the gas engine, one 7 h.p. Blackstone Petrol Engine driving a Centrifugal pump capable of delivering 17,000 gallons per hour, installed in 1929 and used for transferring water from the new Well D. to the main pumping Well A.

The supply is pumped directly into the Service Reservoir situated at one of the highest points in the district, through a 6-inch steel main laid in 1908 approximately 4,166 yards in length. The total capacity of the reservoir is 251,000 gallons, which is the effective capacity. The level to the overflow is 11 feet 2 inches, and the supply is drawn off at the bottom. The O.D. level of the draw-off is 254.89 and the top water level 266.06. The reservoir has earth-banked concrete walls, and a concrete roof carried on concrete piers.

Filtration has not been found necessary.

Distribution.

The Council do not supply water in bulk to any authority except that during the present drought about 600 gallons per week are taken by the Thrapston Rural District Council from a hydrant near the reservoir and carted to the parish of Hargrave.

The Council, by agreement with the Thrapston Rural District Council, supplies water to 16 cottages in the parish of Stanwick.

Except for the quantity now being supplied for Hargrave parish as previously mentioned and for a few services connected to the pumping main, the whole supply is constant and is distributed throughout the area by gravitation.

The following is a list of the mains in the area :—

6-inch pumping main, 4,166 yards.
7-inch service main, 2,088 yards.
4-inch service main, 2,904 yards.
3-inch service main, 5,230 yards.

Sanction has been obtained for a loan of £420 for an extension of 4-inch main 1,000 yards long, work on which was expected to commence in April, 1934.

The population of the Statutory area is 3,683 (1931 Census), and the population now supplied is estimated at 3,433.

With the exception of 11 connections supplying 9 houses, and 3 supplies for farm purposes only, all properties are supplied from the Service Reservoir. In the extension of the 4-inch service main referred to above, it is intended to disconnect six of the services supplying seven houses from the pumping main and re-connect them to the extension of service main.

The total number of properties in the area supplied by town's water is 1,011.

The total number of properties in the area not supplied by town's water is 66, principally outlying farm premises, and a few houses in the town which have private supplies from wells.

The total number of service connections, including standpipes for houses not individually connected and services supplying taps inside two or more houses, is 435.

The total number of fire hydrants is 77.

The average daily consumption of water for February, 1934, was as follows :—

All purposes	67,600	gallons.	18.62 gallons per head.
Trade	10,000	,,	
Domestic	57,600	,,	15.86 gallons per head.

The actual supply available in February, 1934, was the wells' yield of 170,000 gallons per day.

Recent analysis of the water shows that it is of good quality for a gravel source.

Maintenance.

The amount of outstanding loans is £3,223 2s. 10d. The present cost of working and maintenance is £850. Charges based on Rateable Value are :—

2s. 2d.	per quarter	up to £4.
3s. 3d.	,,	£4 to £6.
4s. 0d.	,,	£6 to £10.
5s. 0d.	,,	£10 to £15.
6s. 0d.	,,	£15 to £20.
Over £20.	6¼% on Rateable Value.	

The present return from water rate is £1,020, and the estimated profit on the undertaking £170.

ROTHWELL URBAN DISTRICT.

Population (1931), 4,516. *No. of houses*, 1,222.

The present undertaking is owned by the Urban District Council. The water-works were constructed in 1902-3 at a cost of £9,540. Since that time extensions and improvements have cost £12,365. In 1921-26 the mains were extended at a cost of £850 ; a new High Level Tank in 1931 cost £1,175 ; and an additional filter, etc. in 1933 cost £800.

All the above mentioned sums were expended out of loans sanctioned by the Ministry of Health.

The supply when the works were completed in 1904 was adequate until June 1914, when owing to the development of ironstone mining, a large part of the water supply was diverted. In December 1914, the yield dropped to one-third the previous minimum.

A report was prepared by the Council's Advising Engineer (Mr. W. Keay, Civil Engineer, Leicester) in 1915, and eventually application was made for sanction to raise a loan for extending the collecting area and providing a pressure filter.

Sanction for a loan was not granted by the Ministry of Health.

In view of the very serious shortage of water, the Council decided to carry out the Engineer's scheme without resorting to a loan. Eventually the collecting area was extended by laying 1,400 yards of 6-inch drain, and a pressure filter installed, at a total cost of £2,170, the whole cost being borne out of revenue by means of a temporary increase in the rate over a period of two years.

This scheme was completed in May 1916, and proved most successful and satisfactory.

The quality of water has not fallen below standard, but since the original supply was laid, pressure filters have been installed.

The following are the characters of the present supply :—

Source.

The water supply from the springs at Shotwell Mill is derived from the porous ironstone strata of the inferior oolite series overlying the impervious upper lias clays.

In common with other similar sources the yield is variable, usually issuing at a maximum rate in December or January, and reaching a minimum about October.

The average yield in January, 1934, was 81,800 gallons per day, the minimum for that month being 66,500 gallons per day.

There is actually no storage or impounding reservoir. The water gravitates to three small tanks, each of a capacity of 40,000 gallons.

These tanks were originally designed and constructed for the purpose of softening the water, each tank being sufficient at that time (1904) for a day's requirements. Lime was used, so that three tanks were necessary for treatment of each day's supply. One tank was used for mixing, the second for settling and the third being ready for delivery into the service reservoir.

When the daily consumption exceeded 40,000 gallons, it became difficult to treat with lime in the present tanks, so the treatment was abandoned.

The water is conveyed as required into a well, and pumped to the service reservoir.

The pumping is done by gas engines (two engines 26 B.H.P. each) geared so as to deliver about 10,000 gallons per hour to the service reservoir, a distance of about 1,270 yards away.

Service Reservoir.

The covered service reservoir is of brick and concrete, 50 feet by 50 feet by 15 feet 9 inches, and is situated in Rushton Road. The effective capacity is about 220,000 gallons. Top water level is 437 feet.

In order to give sufficient pressure to the higher parts of the district, the water was pumped over a standpipe at an elevation of 470 O.D.

In consequence of building developments in Desborough Road, which is the highest part of the town (424 O.D.), the supply to the houses in that area was restricted to the hours when pumping was in operation.

To ensure a constant supply to all the high parts of the town at all times, and protection in case of fire, a covered steel tank, of 23,000 gallons capacity, was erected in 1930 at a level of 480 feet.

The district has now been zoned, one part being fed from the high level tank, and the remainder of the town is on the low level supply from the service reservoir.

In the original supply no filtration was necessary, but in 1916, when the yield diminished and it was necessary to extend the collecting area, as some of the drains were shallow and a certain amount of surface water was obtained, it was decided to instal filters.

There are now two pressure filters, " Bell " type, 8 feet in diameter, each having a filtration area of 100 feet, the maximum rate of filtration being 10,000 gallons per hour each.

The coagulant used is Sulphate of Ammonia.

There is no treatment other than filtration.

Distribution.

There are no supplies in bulk.

There is a constant supply by gravitation as indicated above. The population of the Statutory area (1931 Census) is 4,516, and 4,350 are served.

1,285 properties are supplied from the service reservoir or high level tank. 35 properties are not supplied ; these are farm houses, cottages, etc. scattered outside the urban area.

There are no standpipes for domestic supply. All have taps in kitchen or just outside, and in some cases in yards one tap supplies several houses.

Fire hydrants are fixed throughout the area at prescribed and convenient distances, having regard to the property served.

In addition, underground tanks have been constructed in zoned districts near to each factory, so as to obtain a direct supply from the main, which is more effective than hydrants, and are so placed as not to interfere with traffic in case of fire.

The average quantity supplied per 24 hours was :—

1933	—	75,500 gallons.
1932	—	73,500 ,,
1931	—	68,500 ,,

No figures are available showing supply for trade purposes. In 1934 (January) the actual supply available was 81,800 gallons per day.

In view of the exceptionally dry season, and the minimum yield being only equal to the demand, the Council instructed their Engineers to consider the possibility of augmenting the supply in case of need.

The quality of the water is remarkably good for its class. The hardness is 21° (14° temporary).

Maintenance.

Loans outstanding £4,185.	
Cost of maintenance — expenses	£840
Loan repayments	£303
	£1,143

No separate charge is made for water used for domestic purposes, the only charge being for trade, motors, etc. The cost is included in the General Rate, and is equal to 1/3d. in the pound.

There do not appear to be any supplies available for emergency.

A supply, however, is probable on the west side of Rothwell and south of the ridge in the direction of Thorpe Underwood, and if trial holes proved successful, it would be necessary, to make the supply available, to construct a well, pumping station, etc. at a cost of probably £2,000.

RUSHDEN URBAN DISTRICT.

Population (1931), 14,248. *No. of houses* 3,617.

In 1898 the Medical Officer of Health reported that the water supply was derived from surface wells (28 feet in sand) situated in the parish of Wymington. They were sunk by the

Local Board in 1893, and at that time the yield was 100,000 gallons. This supply, notwithstanding the sinking of an additional well, had decreased by half in five years, and it was proposed to bore through the upper lias clay to 250 feet. This trial boring was a failure, and another attempt to find water was made at Sharnbrook in 1900. In this way several hundred pounds were spent without result. The next experiment was made near the gas-works at Irthlingborough, where—as has since been found—the valley gravels yield a vast quantity of water.

The possibility of surface impounding reservoirs was then examined :—

(*a*) The construction of two reservoirs, one in Newton Brook, near Higham Park, and the other in the Yelden Brook. Unfortunately, building developments were taking place in the catchment area, so that the cost of acquisition was high. The scheme was estimated to cost £95,000.

(*b*) Two impounding reservoirs, one on Podington Brook, and the other on Newton Brook. As there was some doubt whether the underlying oolite could be made water-tight, the scheme was not recommended : cost £92,000.

(*c*) Podington and Wollaston : cost £73,000.

(*d*) Harrowden—a single reservoir—at a cost of £63,000.

(*e*) SYWELL : An Act of Parliament had already been secured for this scheme, and Rushden would only obtain four-fifths of the supply. Estimated cost £69,000.

The engineer recommended the Harrowden Scheme, but was in the meantime instructed to continue his investigations at Sharnbrook.

In 1901, the Higham Ferrers Water Company offered to sell Rushden a bulk supply of 200,000 gallons at an agreed price. The engineer reported that it was impossible to guarantee a permanent supply from the gravels at Sharnbrook, and recommended the Council either to seek Parliamentary powers for taking water from the river Ouse, or to adopt one of the upland reservoir schemes which he had recommended.

In 1904 a baptismal service in Rushden had to be adjourned owing to scarcity of water.

Present Undertaking.

The present undertaking is the property of the Higham Ferrers and Rushden Water Board ; it serves Higham Ferrers, Rushden, Irchester, Wollaston, Wymington and Mears Ashby Hall, and gives an auxiliary supply to Earls Barton. The area of supply is (a) Statutory 7,482 acres, (b) Non-Statutory 7,672.

The present works were constructed at a cost of £99,144 in 1902-7. Since then £8,850 has been borrowed for working capital, extensions and improvements. A large improvement scheme is now under consideration.

The supply at all times has been adequate, but the margin of safety was low in 1921, and 1933-4.

Source.

The impounding reservoir at Sywell is in the Upper Estuarine Clay, Lower Estuarine series, and Northampton Sand overlaying the Upper Lias Clay.

The reservoir is fed by rainfall, and springs issuing from the Northampton Sand.

The average yield for 25 years, has been 760,813 gallons per day.

The top water level is 68½ acres in area and 260.00 O.D. The capacity of the reservoir is 236,000,000 gallons.

Transmission.

The water is conveyed by an 11-inch pumping main to the service reservoir at Rushden, a distance of 10½ miles. The pumps (which are in duplicate) are worked by 42 h.p. Suction Gas engines. The service reservoir, which is partially underground, is constructed of mass concrete, and is situated on the Bedford Road, Rushden. Top water level is 337.50 O.D. The highest point served is approx. 286.00 O.D. The draw-off level is 225.50 O.D. Capacity is 826,436 gallons.

Filtration is considered necessary owing to the fact of the open reservoir and algal growths, etc. Three sand filters, with a total area of 2,016 square yards, are used ; they filter the water at the rate of 4 inches per hour. Sand and graded gravel are the coagulants used. No other treatment is required.

Distribution.

The following quantities were supplied in 1932 from the pumping main :—

Mears Ashby Hall	118,000 gallons
* Earls Barton	453,000 ,,
Wollaston	7,277,000 ,,
Irchester	14,597,000 ,,
Wymington	2,271,000 ,,

* *auxiliary supply only.*

A constant supply is afforded by gravitation from the service reservoir to a population of 22,331, including 17,688 in the Statutory Area. A supplementary supply is given to Earls Barton, population 2,574.

At Rushden the majority of the town is served, with the exception of the Court Estate, which is on the same level as the service reservoir.

3,854 properties in Rushden and 770 in Higham Ferrers are served by internal pipes, and 146 properties in Rushden and 28 in Higham Ferrers are supplied by stand-pipes, 28 and 6 respectively.

91 properties in Rushden and 20 in Higham Ferrers are excluded owing to the fact that they are on the same level as the reservoir.

There are 200 fire hydrants in Rushden, and 53 in Higham Ferrers.

The average quantities supplied are :—

Domestic	374,404 gallons per day
Trade	43,101 ,, ,, ,,

116,000,000 gallons were in stock in January 1934, which was sufficient for approximately 232 days.

The unfiltered water is of average quality for a surface reservoir on agricultural and meadow land. The filtered water conforms to the recognised standards of purity. The hardness is only 12 degrees, of which 8.5 degrees is permanent.

Maintenance.

Outstanding capital loans—£78,264.

Cost of working and maintenance 1932/3—£9,340 19s. 1d.

Return from water rate (2/- in £)—£9,057 12s. 7d.

Deficit (1932/3) (recoverable from the Constituent Authorities)—£265 6s. 6d.

The works at Wymington are still retained. They have an average daily yield of 3,681 gallons. There is a service reservoir at Wymington with a capacity of 226,500 gallons.

WELLINGBOROUGH URBAN DISTRICT.

The Wellingborough Waterworks were established by the Board of Health in 1871 at a cost of £26,550. The scheme consisted of a well and pumping station at Bushfields. Between 1871 and 1900 the population was doubled, and the Council found it necessary to seek an auxiliary supply. After making an investigation of various sources, they selected an area of seven acres in extent in the parish of Hardwick, one-and-a-half miles from the Bushfields station. The new source, after a full pumping test, yielded 100,000 gallons a day.

The Hardwick scheme consisted of a well 10 feet in diameter and 17 feet deep, from which water was pumped by two 10 H.P. oil engines to a water-tower. From the tower a free supply of 1,000 gallons a day was given, under agreement, to the village of Hardwick, and the remainder flowed by gravity to the existing reservoir of Bushfields—3,414 yards of 6-inch main. After delivery to the brick storage reservoir at Bushfields, the water passed through a softening apparatus and was then pumped to the town service reservoirs. To deal with the new supply a further set of filters was installed at the main station.

In 1905 a new set of pumps and oil engines was installed, and the capacity of the reservoir increased to 320,000 gallons. Improvements were also made in the machinery at Hardwick. Improvements were made in the softening plant in the year 1908, at a cost of £3,650.

The dry summer of 1911 created a water shortage, and fresh trial borings were made at Bushfields. A suggestion was also made that an auxiliary supply should be taken from the Higham Ferrers and Rushden Water Board. The Surveyor, however, was able to solve the difficulty for the time being by driving additional adits to the Hardwick well.

The town passed uneasily through the War years without an actual shortage, and in 1918 it was decided to purchase 156 acres of land around Bushfields in order to avoid the risk of depletion of supplies by ironstone working in the neighbourhood.

In consequence of the drought of 1921, the Higham Ferrers and Rushden Water Board was again approached ; they offered a supply up to 350,000 gallons a day at a charge of 1/- per 1,000 gallons. This proposal did not take effect. Another shaft was driven at Bushfields, and additional adits made at Hardwick, and by this means the crisis was postponed.

In 1932 it was decided to improve the pressure in the higher levels of the town and to make better provision for new housing developments. A booster plant was installed and new mains laid to the upper areas at a cost of £2,360.

The Wellingborough Council anticipated the dangers of the drought of 1933 by going farther afield in search of a new supply. The proposal brought forward by the Engineer included the purchase of a site of ten acres at Orlingbury. Six boreholes were sunk and a yield of up to 200,000 gallons a day was recorded. The site of the new works is one-and-a-half miles from the Hardwick station. The main is laid to Hardwick, and then alongside the existing main to Bushfields. The scheme includes a reservoir of 150,000 gallons at Orlingbury. The estimated cost of the completed works is £12,582.

The works consist of a centrifugal pump, 20,000 gallons per hour capacity, driven by a 25 B.H.P. electric motor which delivers water from an underground collecting tank to Bushfield Pumping Station. In addition there is a small high pressure pump of 800 gallons per hour capacity, driven by a 5 B.H.P. motor, for the purpose of supplying the various farms on the estate.

The Wellingborough water is very hard (about 35°) in its raw state ; the softening process reduces this to about 15.5° (12.5 permanent). It is of fair quality for a source of this character.

BRACKLEY RURAL DISTRICT.

Aynho. *Population* (1931), 367. *No. of houses*, 107.

There is a private supply installed and owned by Mr. Cartwright.

The source of supply is a spring feeding a small reservoir situated in the centre of the village ; this reservoir feeds an electric pump by which water is forced to a service tank on Mr. Cartwright's Estate. The supply from this tank is by gravitation, and water is laid on to fifteen houses and to three standpipes ; this supplies approximately 50% of the parish ; the remainder of the parish obtain their supply from seven pumps maintained and owned by Mr. Cartwright.

There has been no shortage up to the year 1930. Since then there has been no rationing or curtailed supply, simply a warning to use with discretion.

Reports of analyses in 1933 and 1934 were satisfactory.

Croughton. *Population* (1931), 404. *No. of houses*, 119.

There are two public springs situated at the western end of the village on the north side Banbury—Buckingham Road, yielding approximately 1,100 gallons per day ; these springs have never been known to fail. The western half of the village obtain their supply from the above two springs. The eastern half rely on private wells which are mostly dry and have never been satisfactory. A scheme for a piped supply from these two springs has just been considered by the parish council who propose to instal pump, storage tank and mains, costing approximately £600.

Culworth. *Population* (1931), 410. *No. of houses*, 121.

One public well and many private wells constitute the only source of water for this parish.

There has been shortage this year, the amount of water being considerably diminished in certain wells but none has failed completely. A piped supply is necessary.

Evenley. *Population* (1931), 313. *No. of houses*, 99.

There is a private piped supply to this village owned by Major Allen ; the village obtain their water from ten standpipes. The only house with water laid on is the residence of Major Allen. Source of water consists of two springs from which water is pumped by means of an electric installation to a storage tank, capacity unknown. Transmission is by gravity from storage tank to the village standpipes. There has never been any shortage of water.

Several outlying farms have their own wells.

Eydon. *Population* (1931), 422. *No. of houses*, 115.

This village has a public piped supply and about seventy houses have water laid on, payment being 3s. per tap per annum ; in addition there are five standpipes supplying the rest of the village, payment being 2s. per house per annum. There are two parish pumps, one of which keeps failing. The source of the water is a well in " Batchelor's field " ; when the water reaches a sufficient height in this well it simply overflows into a 2-inch diameter watermain and gravitates to the village ; there is no storage tank apart from such storage as the well itself provides. At the time of inspection the level of the water in the well was too low to reach the pipe supplying the village, the village obtaining their water for the time being from the two aforementioned parish pumps.

There are two schemes at present under review to augment the supply of water :—

(a) it is proposed to sink the present well another 5 feet and to instal a mechanical pumping device to feed an elevated storage tank from which water will gravitate to the village. The cost of this scheme is approximately £150.

(b) to instal an alternative supply obtained from two springs situated in Mr. Gostick's field ; water at present is flowing from these springs into Warden Brook. There was a good flow of water at the time of inspection, and there would be an ample supply for the village.

The estimated cost to utilize this source is £1,000.

There are many private wells at Eydon, approximately half of which are dry.

Farthinghoe. *Population* (1931), 211. *No. of houses*, 74.

This village has recently had a public piped supply installed ; it consists of a windmill pump plus an auxiliary electric pump and a service reservoir from which water gravitates to five standpipes. No houses have water laid on.

At the time of inspection the service reservoir was full and there has been no shortage since this installation was erected.

Greatworth, and Marston St. Lawrence.

Population (1931).	*No. of houses.*
97	34
333	92

Greatworth has a public piped supply ; half of the cottages have water laid on ; the remainder obtain their water from five standpipes ; the rent of 5s. per annum per house is paid for having the water laid on. Source of the water is a spring which feeds a ram ; the ram pumps the water into a service reservoir with approximately 4,000 gallons capacity from which there is gravity feed to the village ; the overflow from the ram is collected and piped into another reservoir of about 4,000 gallons capacity. This second reservoir feeds the village of Marston St. Lawrence by means of twenty standpipes ; two large houses and the Vicarage have water laid on. These waterworks were installed in 1924, since which time there has been no shortage of water at Greatworth or Marston St. Lawrence.

Helmdon. *Population* (1931), 415. *No. of houses*, 131.

115 premises obtain water from wells ; 25% of these are dry.

There is a Private Water Supply Company formed about forty years ago ; this Company supplies 18 premises to which water is laid on. There are six premises using standpipes. The source of the water is in " Well Close," consisting of a spring feeding the circular storage reservoir ; supply is by gravitation.

The water company is of the opinion that they cannot supply any more premises, there being only sufficient water for the houses already connected ; cost of works £100.

There is a scheme at present under review to obtain water from a spring, to instal a Beresford Pump and Mains to supply the parish ; the estimated yield from the spring is 8,000 gallons per day ; and the approximate cost of the scheme is £650.

They have always been short of water in this parish, before and since 1930. I have in my possession sixty-five pages of closely-written foolscap, which represents a correspondence on the subject of an improved water supply for Helmdon. The net result of the correspondence was that one well was protected from pollution by surface drainage.

Hinton-in-the-Hedges. *Population* (1931), 122. *No. of houses*, 26.

This parish has a private piped supply installed by Mr. Cartwright. The water is laid on to six premises ; the remainder of the parish obtain their water from four standpipes ; the source of the water is a spring from which water is pumped by a ram to an elevated storage tank, capacity 4,000 gallons ; supply is by gravitation.

At the time of inspection there was only just sufficient water to work the ram. More economic use of the available supply from the spring by installation of an electric pump is very advisable.

In addition to the above there are three public pumps, two of which are dry and one failing.

Kings Sutton. *Population* (1931), 990. *No. of houses*, 280.

This parish obtains its water from a multitude of private wells ; the majority of the wells in the western half of the parish have been dry during the years 1933—34 ; the eastern half can still obtain water from their wells but it is of a very inferior quality.

There is one public parish well (bucket and windlass) situated on the south side of Astrop Road ; this well has never failed.

In 1928 a scheme was brought forward to obtain water from Charlton, estimated cost £4,000 ; the scheme was abandoned. A new scheme is urgently required.

Moreton Pinkney. *Population* (1931), 304. *No. of houses*, 90.

This parish has a public piped supply of water, but only to standpipes of which there are four.

The source is a spring called " Tarry Well " situated on the main Northampton—Banbury Road in the centre of the village.

The arrangements for collecting the water are very primitive. The spring feeds a small tank of approximately 100 gallons capacity, from which there are two outlets, one to the main which feeds the four standpipes, and the other to an overflow which supplies a large cattle drinking trough.

One house has water laid on—the supply has been diminished recently, but there has been no actual famine.

Newbottle and Charlton. *Population* (1931), 308. *No. of houses*, 93.

Newbottle is a hamlet consisting of a Manor House, Rectory and two cottages.

The Manor House has its own piped supply fed by a ram ; the supply is sufficient and has never failed.

The Rectory and two cottages obtain their water from two wells (pump).

Charlton. This parish has a public piped supply.

The source is a spring situated to the north-east of the village ; a ram is installed which feeds a service tank; there is also an electric pump working on the overflow from the ram ; supply is by gravitation.

Fifty per cent. of the houses have water laid on, the remainder of the houses obtain their water from six standpipes.

Several outlying farms have their own wells.

There has never been any shortage of water in Charlton.

Radstone. *Population* (1931), 86. *No. of houses*, 22.

The three farms, namely Manor Farm (Wm. Bartlett) ; Coldharbour (Chas. Vicary) ; and Radstone Hall (John Thomas) each has its own ram.

Two of these rams are worked by the same spring, but at present, owing to insufficient flow of water to operate both rams at once they are working alternately at present.

The cottages obtain their water from three public wells which have never failed.

Sulgrave. *Population* (1931), 86. *No. of houses*, 105.

Public and Private wells form the water supply to this parish.

The public wells are two in number, one of which is failing at the present time.

There is a good spring on Mr. Cave's farm, and this source of water as a public supply is suggested at an estimated cost of £650 for an automatic electric pump and 2-inch water mains.

Syresham. *Population* (1931), 582. *No. of houses*, 169.

This parish derives its water entirely from private wells, twenty-five per cent. of which were dry at the time of inspection.

Messrs. King's Brewery have a good supply of water which they obtain from a spring in a field known as " Parson's Close " ; a storage tank is installed and pipes laid from this tank to their works. There is another spring in the vicinity, the exact situation being " White Gate Ground " and " Little Ploughed Field." The water from this spring is used for cattle and at the time of inspection was running at a rate equivalent to the maximum delivery from an inch bore pipe.

This spring has never been known to fail, and should offer a possible source of supply to Syresham.

Thenford. *Population* (1931), 125. *No. of houses*, 25.

This small parish is entirely dependent on private wells. There is a Manor House and a Manor Farm which each have their own private supply and pumping installation.

There is no shortage of water.

Thorpe Mandeville. *Population* (1931), 150. *No. of houses*, 40.

This parish obtains its water supply from two public wells and six private wells.

There was no shortage previous to 1930, but since then there have been failures from time to time, and at the time of inspection one Public well was dry.

Whitfield. *Population* (1931), 140. *No. of houses*, 41.

This village was formerly largely owned by Worcester College, Oxford, and the College Authorities sank a well over which there is a wind engine which pumps water into a 10,000 gallon concrete reservoir. From this reservoir supply mains are laid to four standpipes in the village, and seventeen houses where the water is laid on.

The supply was taken over by the District Council some years ago, and was sufficient for a time. But the combined effect of the drought and increased consumption has caused a shortage, and during the Summer water was turned on for only two hours a day.

During 1934 the Council sank another well, 20 feet deep, in the Northampton sand. The supply was good at first, but gradually diminished. The consulting engineers advise that the well be deepened a further 5 feet and re-tested.

BRIXWORTH RURAL DISTRICT.

Boughton. *Population* (1931), 578. *No. of houses,* 129.

Present Supply : This is a private piped supply owned by Mr. C. E. Kimbell of Boughton which supplies water to approximately 90 houses with a population of 300.

The Northampton Borough Council supplies approximately 60 houses with a population of 200.

Mr. Kimbell's supply has always been adequate. Two years ago a pumping plant was added to the ram system to cope with emergencies.

Analyses recently taken showed the water to be satisfactory in quality.

The water is obtained from springs at the " Grotto Spinney " and is pumped to an iron tank reservoir with a capacity of about 7,000 gallons.

Approximately 24 houses have an internal supply, and there are about five standpipes.

Mr. Kimbell has arrangements in hand for increasing the water supply in view of contemplated building development in the near future.

Brixworth. *Population* (1931), 1,173. *No. of houses,* 319.

The village obtains its water supply almost entirely from private shallow wells and from public springs which derive their water from built-up areas and so are liable to pollution. The water available during the recent drought years has been very unsatisfactory in quantity. Many houses have no well on their property, and several wells have been dry, so that a number of people have had to carry water considerable distances. Some 100 houses at the upper end of the village have been seriously short of water and have been supplied by carting the water in a tank and lorry. The Parish Council has denied a shortage of water, but there is no doubt that a scheme should be prepared for a supply of water adequate in quantity and quality for the entire village.

It is reported that the Northampton Borough Council has agreed to supply water to Brixworth at a cost, and to lay a main of sufficient size to fit in with any scheme, but that the cost would be prohibitive without help from the County Council and the Government.

It would appear that water obtained locally is not only liable to pollution but that it is very hard, and a close investigation into the possibility of a regional scheme is urgently called for.

Cold Ashby. *Population* (1931), 249. *No. of houses,* 69.

The village is supplied by public wells and a spring. The wells are shallow and in some cases liable to pollution. During the summer of 1933 there was a fear of water shortage. This has been to some extent overcome by the deepening of an existing well in the summer of 1934, when a copious supply was obtained.

Coton. *Population* (1931), 83. *No. of houses,* 24.

One or two of the larger houses are supplied by the Northampton Borough Council. There are two private wells, one of which is unfit for use, but the majority of houses are dependent on these wells. There are four houses without any water supply within a reasonable distance.

Cottesbrooke. *Population* (1931), 213. *No. of houses,* 56.

The village is supplied partly from a spring (near Square Head Spinney) and from numerous wells scattered about the village. Cottesbrooke Hall, the Grange, the Rectory, and a few estate cottages, get their water from a private supply on Capt. Brassey's estate. Any overflow from this supply is run into the public supply tank, but recently there has been no water reaching the overflow pipe for distribution to the public supply system.

There are five stand-pipes in the village and several wells. The supply of water, both from the main and from the wells, has been inconstant.

Creaton, Great. *Population* (1931), 324. *No. of houses*, 102.

There is a public piped water supply, but it is very primitive and unreliable. Land drains from cultivated fields, and in one or two cases tapping small fissures, empty into a tank which is situated at the top of a hill, and the water runs by gravitation to the village.

There is a public well fitted with a hand pump situated on the Green. The well is about 10 feet deep and is liable to pollution. There is also a spring near the cottages known as Little Creaton.

There are numerous private wells, but the village is very inadequately supplied with water and has been for many years. The shortage of water has seriously affected the Metropolitan Brick Co., who are extending their works which are situated in the Creaton Lane near the Brixworth Railway Station.

Draughton. *Population* (1931), 90. *No. of houses*, 22.

This village obtains its water from shallow wells. Two houses have no supply within a reasonable distance. The shortage of water during the summer of 1934 has been serious.

East Haddon. *Population* (1931), 413. *No. of houses*, 126.

Water has been obtained for many years from a well known as the Priest's Well, situated near the top of the Ravensthorpe Road. In 1890 the Parish installed two ram pumps to pump the water to a water tower situated in the centre of the village. These rams were driven by a small stream on the boundary of East Haddon and Ravensthorpe. When this stream dried up, which it did nearly every summer, there was no water to drive the rams, and consequently no water in the village. This state of affairs was remedied in 1929, when a concrete collecting tank, holding approximately 20,000 gallons, was installed, together with an electric centrifugal pump which now pumps water *via* a 3-inch rising main to the water tower, which holds 6,000 gallons. The water is not subjected to any form of treatment. The average normal yield is about 17,000 gallons per day, but this was halved during the past year.

Water is laid on to 64 houses and there are 11 standpipes.

The scheme is run at a loss, as no water rate is charged, the cost being included in the special sanitary rate of the village. The loan was for £700, plus £350 for the extension of the rising main, and a proportion of the loan is still outstanding.

There are several private wells in this village, and a spring, believed to have been used by the Romans, which has never been known to fail and is used by the village in emergency.

The source of the main public supply being gravel, the quantity of water available is liable to very marked fluctuation, and there is a risk of the supply failing during drought.

Guilsborough. *Population* (1931), 466. *No. of houses*, 127.

The only public supply of water is from a well with a hand pump situated near the council houses in Nortoft. This well is fed from an overflow of a well on private property. The remainder of the village relies on about fifty private wells.

There has been a serious shortage of water at Nortoft during last summer ; and it is obvious that the time is over-ripe for an adequate water supply to the village.

Hanging Houghton. *Population* (1931), 84. *No. of houses*, 28.

This parish forms part of the Isham Estate. There are some seven or eight wells in the village, of which four are fitted with a hand pump and the remainder with windlass and bucket. Four families are stated to be dependent on water which has to be carried more than fifty yards.

Hannington. *Population* (1931), 114. *No. of houses*, 35.

This village has no public supply of water. At least one house has no water supply within a reasonable distance, and several families have been using water which has been shown not to be fit for domestic purposes. In July, 1932, the Parish Council intimated that it might be necessary to convey water by tank and lorry to the village in the near future.

Hazelbeech. *Population* (1931), 106. *No. of houses*, 29.

This village obtains its water partly by a supply on property owned by Mrs. Ismay, of Hazelbeech Hall, and partly from two wells. It is stated that the supply is lower than at any time during the last twenty-five years.

Holcot. *Population* (1931), 305. *No. of houses*, 87.

There are thirty-seven wells from three of which water is drawn by means of a windlass and bucket ; the remainder have hand pumps. Seven or eight families have to carry water more than fifty yards, while a number of wells are so inadequate that housewives have to queue and wait their turns while the wells fill.

The wells vary in depth from 30 feet at the South End, near to the Rectory, to mere dip wells in the more northern part of the village.

Holdenby. *Population* (1931), 181. *No. of houses*, 44.

This village has one public well, and there are also private wells. Although there has been no official complaint of shortage of water, it is known that there has been a shortage for flushing drains and sewers.

Hollowell. *Population* (1931), 267. *No. of houses*, 42.

There is a primitive system of water supply in this village which provides a few houses with a piped supply from a spring. There are several private wells.

Lamport. *Population* (1931), 148. *No. of houses*, 38.

There is a public well and several private wells in the village. It is reported that there has been a serious shortage at the " Swan Hotel."

Maidwell. *Population* (1931), 128. *No. of houses*, 30.

The village obtains its water entirely from private wells It is reported that there is considerable difficulty in finding water by well sinking in the locality.

Moulton. *Population* (1931), 1,638. *No. of houses*, 464.

This parish is rapidly being developed as a satellite village to Northampton. For more than ninety years water available in local wells has been unsatisfactory in quality and in quantity. Of recent years rapid building development has necessitated the provision of a more wholesome and constant supply of water. The Northampton Town Council have a pipe line along the Kettering Road, and this supplies approximately 40 to 50 houses with a population of about 500. The remainder of the village depends, as formerly, on numerous private wells which in many cases are subject to pollution. In a village of this size, growing with great rapidity, there is urgent need for the provision of water which is wholesome and not subject to periodic fluctuation in quantity.

The risk of an epidemic of water-borne disease, such as typhoid, is greatly enhanced in a community like Moulton, which is growing in size and which has an increasing proportion of its population moving to and from the village daily. The prevention of such risk is a moral necessity when it can be bought at such a small cost by the substitution of modern sanitary methods for the primitive insanitary arrangements of the small isolated rural communities of a century ago.

Naseby. *Population* (1931), 399. *No. of houses*, 112.

This village has no public source of water. It depends entirely on private wells. Several houses are not within a reasonable distance of water.

Old. *Population* (1931), 291. *No. of houses*, 76.

The village depends mainly on private shallow wells, many of which became very low in the summer of 1934. There is a public spring which gathers water from built-on land and so is liable to pollution.

Overstone. *Population* (1931), 235. *No. of houses*, 63.

This village depends entirely on private shallow wells for its water supply.

Pitsford. *Population* (1931), 470. *No. of houses*, 138.

The village depends on private and public wells, and although it is repeatedly stated that there is no shortage of water in the Parish, complaints have been made for many years concerning the quantity and quality of water available.

The history of the water supply to the Council's houses in the village provides a lesson which needs to be remembered when new houses are being built. After the Council's houses had been built, two wells were sunk, and of these one ran dry after two days' pumping and remained so for some time, while the other was only capable of receiving surface water. These wells are still causing trouble periodically through shortage of water. An ample supply of wholesome water is one of the prime necessities of life, and it is essential that such provision is considered when building is contemplated.

Ravensthorpe. *Population* (1931), 281. *No. of houses*, 85.

Most of the information given here has been extracted from a full and admirable report compiled by the Women's Institute. The village depends entirely on fifty-four shallow wells and two springs, the former varying in depth from 12 to 25 feet. The village is built on a layer of Northampton sand, so that the water obtained from the wells is that which has percolated the built-up area of the village, the churchyard, and the surrounding country. In the report compiled by the Women's Institute, details are given of forty of the wells, and also the results of bacteriological examination of water from thirty-two wells. It will suffice here to state that in every case where bacteriological examination has been carried out, the water has been shown to be polluted. This is not surprising when one considers the nature of the wells and of the gathering ground, and that the village sewer, which was laid about forty years ago, passes in close proximity to many of the wells.

Details of certain wells are of interest :—

Well No. 40. The well of greatest importance in the village. It is a public supply and the most used well in the village. Its position is on the roadside—covered in and pump fixed to a wall, which is retaining wall of a garden some six feet above it in ground level. The sewer runs within a few yards of it. This water was analysed by the local authority some eighteen months ago and passed as fit for consumption The present expert analysis is as follows : Lactose fermenters in 5, 10 and 20 ccs. Liquefying and non-liquefying colonies. Plate well covered.

Well No. 3. The pump serves two households. The amenities of the pump, flat drain close by, approximately one yard from the house. Water too hard for washing but used for all purposes.

Analysis. Lactose fermenters found in 5, 10 and 20 ccs. Large number of liquefying and non-liquefying colonies.

Well No. 5. The pump serves four cottages. It is placed in the garden approximately ten yards from the centre house. Between the well and houses runs the sewer, which on account of the road level is without much fall. The top of the well is of a kind that one would naturally expect from such a position, fairly well protected. Water very hard and used for all purposes.

Analysis. Lactose fermenters found in 5, 10 and 20 ccs. Large number of liquefying and non-liquefying colonies.

The large number of colonies grown from these samples of water indicate that the samples have been polluted with organic matter, while the presence of lactose fermenting organisms in such a small quantity as 5 cc. indicates that sewage pollution has occurred recently.

This account of the water supply at Ravensthorpe is given at some length, not because it is in any way worse off than any other village, but because it is typical of the conditions prevailing in the majority of our smaller villages, and because the report made by the Women's Institute shows clearly the faults which, however glaring they may be in many cases, are usually overlooked.

It is noteworthy in regard to the grossly polluted waters of many shallow wells, that they are, as a rule, clear, sparkling and palatable. The organic filth from cesspools and drains, in its passage through even a few feet of porous soil, is filtered and deprived of suspended matter, but does not lose its dangerous properties. The sparkle and palatability of such water are due to the presence of carbon dioxide which has been formed during the process of putrefaction. Such wells, after a heavy rainfall, furnish a turbid, foul-smelling water due to the heavy rain washing into the well the soakage from leaky drains, manure heaps and churchyards.

Scaldwell. *Population* (1931), 286. *No. of houses*, 80.

There is a public supply by means of a well about 16 feet deep on the Green, and owned by the Charity Trustees. In normal times the inflow is heavy and it is liable to pollution. There is also a public spring in School Lane, near the School—this is also liable to pollution. There are a number of shallow wells in the village varying in depth from 9 to 13 feet. During the summer of 1934 there was a shortage of water.

Spratton. *Population* (1931), 681. *No. of houses*, 182.

This village obtains its water from six public wells or springs. One of these is fitted with a hand pump and another with windlass and bucket. There are also numerous private shallow wells amid the built-up area. There was some shortage of water during the summer of 1934. It is noted that complaints have been received since 1903 of shortage of water and pollution of wells in this village.

Teeton. *Population* (1931), 55. *No. of houses*, 16.

There are three wells which became short of water during the summer of 1934.

Thornby. *Population* (1931), 181. *No. of houses*, 46.

Six private wells provide water—some of these are known to be polluted, and the level of water fell considerably during 1934.

Walgrave. *Population* (1931), 659. *No. of houses,* 174.

Walgrave depends on two public wells and numerous private wells. All of these wells are shallow and liable to pollution. The quantity of water obtained fluctuates, and during 1934 it was stated that supplies were failing.

	Population (1931).	*No. of Houses.*
Althorp	71	14
Great and Little Brington ...	562	... 173
Church Brampton	187	... 49
Chapel Brampton	230	... 60
Harlestone	511	... 138

The above villages obtain their water supplies from a comprehensive estate scheme.

There are storage reservoirs at :—

Great Brington	180,000 gallons.
Harlestone	60,000 ,,
Brampton	10,000 ,,

and water is supplied mainly by gravitation to stand-pipes in the villages.

The water is obtained from Northampton sands and marlstone, and pumped to the reservoirs by wind engine or oil engine pumps and thence by gravity to standpipes. The water is very hard, but free from pollution.

CRICK RURAL DISTRICT.

A great part of this Rural District lies west of Northampton Heights, and is therefore dependent upon superficial water-storage which overlies the lower lias clay.

There are no public piped supplies in the district ; so each village has to fend for itself.

Kilsby. *Population* (1931), 501. *No. of houses*, 133.

There are two public wells, and a third well on public property, but privately used. Water is usually found in the village wells at about 20 feet. The subsoil is stated to be clay, with seams of limestone and ironstone along which the water travels. One of the wells is supplied by a field spring which is piped to the roadside. From this source also, a supply is taken to a collecting chamber, and thence by a galvanised pipe to fifteen houses. The wells became very low during the summer drought, but did not fail altogether.

There are about fifty private wells with ordinary lift pumps. Most of these have held out well.

Crick. *Population* (1931), 681. *No. of houses*, 192.

Crick has two public wells which serve about forty households. They are 30 feet deep, and derive their water from drift and thin seams of limestone which lie above the lower lias clay. For most families an ordinary lift pump is used, but sixteen council houses draw from the same well through pipes. The water from Causeway well was chemically analysed in 1920 and found to be fit for drinking.

The village of Crick, as regards water, may be divided into two parts.

The southern part is built on a bed of sand which in places is of considerable depth. Numerous wells are sunk into this, and draw water from a seam of running sand which lies on top of the clay. The water in these wells is, in many cases, polluted and unfit for use, but the quantity is usually sufficient.

The northern part is on clay which has water-bearing seams of limestone running through it, and wells sunk into this provide a good supply of water, both in quality and quantity.

The water is too hard for washing, but no complaint is made of its taste.

Yelvertoft. *Population* (1931), 349. *No. of houses*, 102.

This village has one public well, sunk 20 feet in subsoil and lower lias clay. It is fitted with an ordinary pump and is usually sufficient in quantity. It failed, however, during the present drought. The water is in any case unfit for drinking.

Investigations carried out by the Women's Institute reveal that there are some 65 private wells, all shallow, in the village. Particulars were given of 87 households, and a very useful map was appended. The water is generally hard and clear. Roughly, twenty families have to go more than fifty yards for drinking water, and fifteen wells failed more or less completely for periods up to three months. Temporary relief was obtained from neighbouring wells which held out. The school well, which failed for a month, has to be filtered before it is fit for drinking.

It is always a little difficult to estimate the quantity used by the various households, as so many factors are involved. The average for a cottage appears to be about eight gallons a day, say two gallons per head ; but one observes here, as elsewhere, a much smaller secondary group of " large users "—farms, and bigger houses—whose supplies are probably as much as ten gallons a head.

Generally speaking, the water supply of Yelvertoft is highly unsatisfactory. It is derived entirely from shallow wells, liable to pollution ; hard, and uncertain in quantity.

Lilbourne. *Population* (1931), 209. *No. of houses*, 62.

There are three public wells. Number 1, in the field near the church, is about 20 feet deep. The well in Shaw's field and the one on the village green are about 25 feet deep, and are mere sumps in the lower lias clay.

The well in Mr. Scott Howkins' field is about 35 feet deep, and draws water from some thin bands of rock in the clay, but is largely fed from the surface.

There seems to be no possibility of a proper local supply in Lilbourne, as the wells fail every year. During the recent drought, water had to be carted to the village for a period of two months.

A large number of private wells are all in the clayey subsoil, draining only surface water, and these wells also failed during the drought.

The question of water supply for Lilbourne is urgent, and two possible schemes are under consideration :—

(*a*) to utilise water from the Rugby Corporation main which passes near the village, and

(*b*) to link up Lilbourne with the regional scheme from West Haddon.

Stanford-on-Avon. *Population* (1931), 53. *No. of houses*, 12.

This hamlet is supplied privately by means of a ram fed from a lake in Stanford Hall Park. Some of the houses are also dependent on private wells.

Clay Coton. *Population* (1931), 71. *No. of houses*, 18.

Clay Coton is dependent entirely on private shallow wells which are fed from surface water. There has been a good deal of difficulty during the current year in obtaining satisfactory supplies owing to the drought, and there are no local sources from which a village scheme can be made. Clay Coton should be linked up, if possible, with a regional scheme.

Barby. *Population* (1931), 471. *No. of houses*, 117.

A study of the water supply of this village is unusually interesting because of the careful report made on all the wells by the Women's Institute. A questionnaire was sent out by them to every well-owner in the village, and more than sixty replies were received.

There are only two public wells, both of which are spring-fed and fitted with pumps. They give a good supply and are used by about twenty families.

From the report of the Women's Institute, it appears that the wells are all shallow, varying in depth from 18 to 42 feet, with an average of about 28 feet.

Forty-seven of the wells yield a clear water, of good quality and taste; six are definitely undrinkable, and ten become cloudy and unpleasant after rain. Only fourteen wells failed during the present drought.

Apart from the public wells, there are at least three good springs in the village which do not dry up. The water in general is very hard, and several families use a walled pond for washing-water.

The one piped supply which serves four Council houses is not very satisfactory, as it contains a good deal of sediment, and often only a trickle of water is obtainable from the pipe.

DAVENTRY RURAL DISTRICT.

The greater part of this Rural District consists of the upland country known as the Northampton Heights, from which the Leam, the Cherwell, and the Nene take their origin. These streams attain no great size, however, within the district, and are unsuitable as a source for regional supplies. The area is, as a whole, well-watered, but the individual springs are scattered, and unreliable as permanent supplies. The chief problem for a regional scheme is to group various springs in such a way as to secure a permanent flow of reasonable quantity. The deep sources—the middle lias—are available on the eastern slopes, and have been used at Long Buckby ; but in the west this formation is superficial, and its outcrop springs are liable to fail in dry weather.

The Daventry Rural District Council have made a determined effort to obtain suitable regional supplies, and have been successful up to a point. Great difficulties, however, have been met in dealing with the western villages such as Braunston, which lie close to the lower lias clay.

Badby. *Population* (1931), 440. *No. of houses*, 123.

In 1901 the County Council directed attention to the bad condition of the water in this village, and two years later the Rural District Council began to consider a scheme of public supply. The first plans brought forward—estimated to cost £1,000—were investigated by the Local Government Board in 1904, but various difficulties arose, and it was not until 1905 that the present system was installed at a cost of £1,060.

The source of supply is a marlstone well 12 feet in depth. The water is pumped by wind motor to an underground brick reservoir in the village by a 3-inch main. The capacity of the service reservoir is 7,500 gallons. The water is served by gravity to eleven stand-pipes. Approximately twenty-six houses are served by internal pipes.

The water supply of Badby has withstood the drought well, and one may hope that it will be possible to lay on the service to a larger number of houses. The water is not treated by filtration or otherwise.

Capital Loans outstanding	£106.
Cost of maintenance	£99 per annum.
Water charges	$3\frac{3}{4}$ per cent. on gross value.
Return from charges	£41 per annum.
Deficit	£58 per annum.

Ashby St. Ledgers. *Population* (1931), 210. *No. of houses*, 46.

This village has the advantage of a private water supply owned by Lord Wimborne. Surface water runs to a lake served by feeders from grass-lands, and is pumped thence by a petrol engine to a covered brick reservoir (quarter of a mile from the village) at ground level, but high enough to supply the standpipes. The water undergoes sand filtration at atmospheric pressure. The whole village is served by standpipes.

Flore. *Population* (1931), 786. *No. of houses*, 242.

Flore has two public wells (50 feet deep) and one spring for public use. The first well supplies twelve houses, and the second, eight ; the dip-well from the spring serves ten houses. A number of householders whose wells have failed, have to travel considerable distances for the public supply. Several private wells failed in 1933, but the public wells held out. All the wells are shallow in type, and surface water drains into many of them. The water is hard, and the wells have an unpleasant taste after rain. In many cases the water is turbid, and has a sandy deposit.

The quality of these wells is poor, and the village urgently requires a public piped supply from less doubtful sources.

Dodford. *Population* (1931), 242. *No. of houses*, 58.

There is a good quantity of water-bearing drift gravel in this neighbourhood. The one public well is about 20 feet deep, in sand. There is also a public dip-spring. Eight families use the village pump, and twelve use the spring. The water is hard, but no complaint is made of colour or taste. There are three private wells, all of the shallow gravel type.

It is evident from the reports of the Women's Institute that many residents have to go long distances for their supplies.

Braunston. *Population* (1931), 1,016. *No. of houses*, 269.

This village has five public wells. They are shallow and derive supplies of indifferent quality from sand overlying the lower lias clay. The public and the private wells appear to have a good deal in common, including the village sewage. The need for a public piped supply is urgent, in spite of the fact, quoted recently in a newspaper, that there are 82 people in the village with an average age of 64 years.

Unfortunately the problem of finding water is very difficult. Braunston is in the midst of lower lias clay, and there are no adequate sources within easy reach. The possibility of linking Braunston with a regional supply is being carefully explored.

Byfield. *Population* (1931), 868. *No. of houses*, 237.

Byfield has two public springs. About thirty families use the Westhorpe Well, which supplies the whole of that area. Many householders have to travel considerable distances for water, up to 300 yards. Twelve families use Dodd's Well, and about six, the well near the chapel. The supply has not failed during the drought ; the wells vary from 20 to 50 feet, and probably derive their water from the marlstone which is fairly superficial in this district.

A public piped supply is required for the village, and the Rural District Council are engaged in a survey of the most suitable springs in the neighbourhood.

Catesby. *Population* (1931), 91. *No. of houses*, 24.

Catesby has a private water supply owned by Mr. A. Attenborough. The water is collected from springs in Catesby tunnel, under an agreement made with the L.N.E.R. The source is marlstone, which was deeply cut in making the tunnel. Water is lifted by a ram to a tank in the village. There are no standpipes, and the villagers obtain their supply direct from the tank.

There appears to have been no shortage during the drought. A piped supply would not be expensive to instal.

Charwelton. *Population* (1931), 165. *No. of houses*, 45.

Charwelton has a private supply, owned by Mr. T. H. Brightwell. The scheme was installed by the late Sir Charles Knightley. Unfortunately, there has been considerable shortage of recent years, and only a few houses are adequately served. The water is derived from two shallow wells issuing from the base of a thin covering of Northampton sand. There is no storage. The water from the reservoir gravitates through a 2-inch iron main to twenty-seven stand-taps in the village. In a few cases water is laid on to houses.

The supply as a whole is a failure, not because of the drought, but owing to defects in the initial scheme. A new source is urgently required.

Everdon. *Population* (1931), 406. *No. of houses*, 120.

Everdon has two public wells which derive their supply from the marlstone. One of these is about 25 feet, and the other—like most of the private wells—very shallow and of doubtful quality.

There are approximately sixty private wells which serve 117 families. The water is clear and hard. The Women's Institute enquiry reports a shortage for two weeks during last summer.

Farthingstone. *Population* (1931), 177. *No. of houses*, 55.

Farthingstone had a poor water supply until 1930, when the generosity of Mr. Agnew made it possible for the village to have a public piped service. The present scheme was established at a cost of £1,950 and is owned by the Rural District Council. The source is a hillside spring issuing from the Northampton sand about a mile from the village. The water is pumped by a ram to a brick reservoir of 20,000 gallons which commands the whole village. The scheme provides for an auxiliary petrol engine. The average supply of 14,500 gallons a day serves the majority of the households. There are five stand-pipes and five hydrants.

The water is clear and palatable, and both chemical and bacteriological analysis show that the quality is good. The total hardness is 26.9 parts per 100,000 (17.5 temporary).

Cost :—

Outstanding loans	£973
Maintenance	£75
Water charges	12½ per cent. on net annual value.
Return from charges	£31
Deficit	£43

Long Buckby. *Population* (1931), 2,326. *No. of houses*, 702.

The modern history of Long Buckby water supply begins with an outbreak of enteric fever in 1887. The Medical Officer of Health, Dr. Churchouse, rightly attributed this epidemic to polluted water. He constantly urged his council to procure a fresh supply, and ultimately lost his appointment for his pains. The 116 wells stood condemned until, in 1895, the inhabitants passed an almost unanimous resolution " that no new scheme of water supply be adopted." This seems to have been a signal for activity, for in 1897 the Rural District Council, after considering a strongly adverse report by Dr. Bruce Low to the Local Government Board, adopted plans for a water scheme at a cost of £3,740. The loan was duly sanctioned, but many delays occurred, chiefly in connection with the purchase of a site. In 1904 a loan for £5,400 was sanctioned and a further £1,500 in 1905. In October, 1905, the water supply of Long Buckby was turned on.

The supply appears to have been adequate until the drought of 1921 ; and again in 1923 there was a partial failure. During the present drought the state of the well has given rise to a good deal of anxiety.

The present undertaking is owned by the Rural District Council. The water is derived from a middle lias well 250 feet deep, giving an average daily yield of 36,000 gallons. It is pumped from the well by a heavy-oil engine through a 4-inch main to a concrete reservoir. This reservoir has a capacity of 250,000 gallons, and is situated a mile from the centre of the town and mercifully well above its level. The water is not treated or filtered. The great majority of the houses have a service laid on, but some polluted wells appear to be still in use. The water contains about seventy grains per gallon of solid residue, chiefly lime and magnesia. It is organically pure.

Present costs :—

Outstanding loan charges	£356
Maintenance costs	£730
Water charges	6¼ per cent. of gross value.
Income from rates, etc.	£622
Deficit	£108

Newnham. *Population* (1931), 356. *No. of houses*, 103.

Newnham village has one public well, said to be 50—60 feet deep. It has an ordinary hand pump, and the supply has not failed so far. The private wells are shallow and of doubtful quality.

Helidon. *Population* (1931), 148. *No. of houses*, 52.

Helidon has one well and one spring. Like the dozen or so private wells, the former is shallow (20—25 feet) and of doubtful quality. The wells have maintained their supply during the drought.

Fawsley. *Population* (1931), 29. *No. of houses*, 10.

Canons Ashby. *Population* (1931), 49. *No. of houses*, 13.

Brockhall. *Population* (1931), 38. *No. of houses*, 7.

These hamlets are served tolerably well by shallow private wells.

Norton. *Population* (1931), 315. *No. of houses*, 94.

The village of Norton has the benefit of a private supply owned by Lady Beatrice Thynne. The water is obtained from Northampton sand by means of drains laid in the hillside, and gravitates to a brick reservoir about a mile from the village. The cottages are mostly supplied by stand-pipes in yards.

During the drought the quantity gave rise to some anxiety, but no actual failure is recorded.

Preston Capes. *Population* (1931), 156. *No. of houses*, 50.

Preston Capes also has a private supply, originally installed by Sir Charles Knightley. The source is a shallow well (14 feet) in the Northampton sand, from which water is pumped by a wind motor to a brick reservoir on a hill three hundred yards from the village. About 5,000 gallons a day are available, sufficient for the four village stand-pipes. The original cost was approximately £400. No serious degree of shortage has been recorded.

Staverton. *Population* (1931), 319. *No. of houses*, 82.

Staverton occupies a peculiar position, because supplies are required for the isolation hospital as well as the village. The existing village supply is seriously deficient. There are no public wells, and the private wells (40—60 feet deep) give a very variable quantity.

The Isolation Hospital, on the other hand, is fed by a ram connected with a spring in the valley which lies to the south. There is a good flow from this and neighbouring springs, and there is no doubt that these sources could be linked to supply the village as well. It would be necessary to instal a pump and engine in place of the ram. A scheme for a piped supply to the village is being prepared.

Stowe-Nine-Churches. *Population* (1931), 219. *No. of houses*, 64.

Stowe-Nine-Churches has two public springs, and there appears to be a fair quantity of water readily available in the neighbourhood. The village is scattered, and attention to the springs would probably serve the needs of the inhabitants.

Watford. *Population* (1931), 324. *No. of houses*, 90.

There are no public supplies. The report of the Women's Institute gives an account of thirty private wells. Many of these have been low during the drought, but there has been no serious shortage. There is, however, a need for a public piped supply for this village, as the local supplies are of doubtful quality, and the water is not well distributed.

Weedon. *Population* (1931), 1,753. *No. of houses*, 425.

The problem of water supply has been under consideration since 1914, as far as my records go. The barracks have an adequate supply from a private company, but the village has been largely dependent on shallow private wells of doubtful quality. The one public well, which is sunk to a depth of 8 feet in the marlstone, serves about twenty houses.

There is an urgent need for a good piped supply for this village. The Rural District Council have had under consideration two alternative schemes.

Welton. *Population* (1931), 358. *No. of houses*, 106.

This village has two public wells, one of which is shallow and draws from surface water, and the other is about 80 feet deep in the marlstone. Seventeen houses are served by a piped supply, but the rest of the village suffers all the inconveniences of variable shallow wells of doubtful purity.

It is desirable that Welton should have the advantage of a piped supply, and it will probably be included in the regional scheme.

West Haddon. *Population* (1931), 714. *No. of houses*, 197.

West Haddon has eight shallow public wells, deriving their supply from the Northampton sand. The average depth is 25 feet, and all the wells are liable to pollution. The private wells are similar in type.

A public piped supply is an urgent necessity for this village.

Whilton. *Population* (1931), 216. *No. of houses*, 62.

Whilton has no public supply. The twenty-eight wells are of the usual type and liable to pollution.

Winwick. *Population* (1931), 153. *No. of houses*, 32.

Winwick has a private piped supply derived from a spring in the marlstone. It is owned by the Hon. E. B. Butler Henderson and serves the whole village except for outlying farms.

Woodford-cum-Membris. *Population* (1931), 1,738. *No. of houses*, 451.

The village of Woodford is supplied by a public company with statutory rights, which was formed in 1870. The capital expenditure up-to-date is approximately £1,800. The water is derived from hillside springs in the Northampton sand, and is stated to average 25,000 gallons a day. The water is served from a brick-built, concrete-lined reservoir on a hill about three-quarters of a mile from the village. It has a capacity of 31,000 gallons. The population of the statutory area is 1,611, and there are 280 properties actually supplied. The quality of the water appears to be satisfactory, but the quantity has been very variable. The Company has a capital of £8,000 and recorded a profit of £150 in the year 1933. The cost of working and maintenance for the year was £150.

There have been from time to time complaints about both the quality and the quantity of the water, and of recent years it has been apparent that considerable improvements are necessary. I am informed that the Company is making plans for the erection of a further storage reservoir of approximately 20,000 gallons. The water has 17° of hardness, of which 11° is temporary.

Approximately one hundred houses on and near the Council housing estate have an adequate supply installed by the Rural District Council. The scheme cost £1,300 and there is an outstanding loan of £735.

EASTON-ON-THE-HILL RURAL DISTRICT.

This small Rural District, which will shortly be incorporated with the new Oundle and Thrapston Rural District, has no serious water problems.

Easton-on-the-Hill. *Population* (1931), 814. *No. of houses*, 227.

The water supply dates from a gift by Nevil Day, Esq., in 1888. The source is a spring issuing from the base of ironstone rock, which has a daily yield of about 20,000 gallons. There is a storage tank of 5,080 gallons in the centre of the village to which water is pumped by a 2½ h.p. engine. The village steel tank is 12 feet above the highest standard, and gives a supply by gravitation to eighteen standpipes. No houses have water laid on from the public supply.

Collyweston. *Population* (1931), 412. *No. of houses*, 108.

This village has two public wells, which derive their water from ironstone (about 25 feet deep). The supply is by means of windlass and pump, and about twenty-six households are served. These wells have not shown signs of failure.

Some sixteen properties are dependent on private wells of similar character, deriving their water from the ironstone. No failures have been recorded.

It would no doubt be possible to instal an inexpensive scheme of public piped supply, similar to that of Easton-on-the-Hill.

Duddington. *Population* (1931), 223. *No. of houses*, 63.

Duddington also has two public wells, 25 feet deep, deriving their water from the ironstone. Twenty-two properties obtain water, by windlass and pump, from these wells.

Enquiries from the Women's Institute disclose that there are thirty wells in the village, none of which has failed. The water is very hard, and many households store rainwater for washing.

A small village piped supply could be installed here without great difficulty.

GRETTON RURAL DISTRICT.

Gretton. *Population* (1931), 704. *No. of houses*, 198.

This village has a piped supply from springs which serves part of the village by means of two standpipes. Elsewhere springs discharge by the roadside to dip-wells, but the majority of the premises are dependent on shallow private wells deriving their water from the ironstone.

There is an agreement with Messrs. Stewart and Lloyds to provide an adequate supply for Gretton if the ironstone workings should interfere with the existing springs.

Harringworth. *Population* (1931), 221. *No. of houses*, 67.

The main source of supply is from springs issuing from the outcrops of Northampton sand on the hillside, and led into a trough on the roadside. There are also a few private wells. There are now a number of stand-pipes fed from springs. No shortage has been reported.

Laxton. *Population* (1931), 108. *No. of houses*, 25.

There is a private well in the village from which water is pumped by windmill and auxiliary petrol engine to a storage tank of about 4,000 gallons.

A pipe is laid on to about half of the cottages in the village. The remainder of the cottages are dependent on private wells, many of which showed signs of failure during the summer, but the main supply described above is ample.

Rockingham. *Population* (1931), 184. *No. of houses*, 43.

There is a private piped supply from the Castle Estate, water being derived from a spring in the Northampton sand. Eleven houses are served by internal pipes, and the rest of the village appears to be satisfactorily served by five stand-pipes.

Wakerley. *Population* (1931), 104. *No. of houses*, 30.

There is one shallow public well on the roadside, but most of the cottages obtain their water from private shallow wells. Several cottages have been very short of water for several summers.

HARDINGSTONE RURAL DISTRICT.

Almost the entire Rural District of Hardingstone, excepting only Brafield-on-the-Green and Denton, is within the statutory area of supply of Northampton Corporation, but at the present time no villages are actually supplied from this source.

This district has no deep sources of supply, and no surface reservoirs except the lakes at Castle Ashby. The area is dependent on superficial sources in great oolite and ironstone. Apart from arrangements with the Northampton County Borough, there is no likelihood of a regional scheme of any size. As the greater part of this district lies close to Northampton, a number of the villages would, in my opinion, be developed quite rapidly if good sanitary services were available. A permanent water supply is therefore an essential condition of prosperity in the Hardingstone Rural District.

Brafield. *Population* (1931), 486. *No. of houses*, 128.

The scheme of water supply was installed in 1903 ; a well was sunk to a depth of 103 feet to the upper layers of Northampton sand ; 92 feet of drift was penetrated before the estuarine beds were reached. The well is 5 feet in diameter and constructed of 4½ feet of brickwork, the upper 10 feet of which is cement jointed. The average depth of water in the well is 11 feet. The supply has failed from time to time in exceptionally dry periods, but it is normally just sufficient for the needs of the village. The original cost of this supply was just under £1,000. The water was finally turned on in the year 1905 after what the Chairman of the District Council described as " the driest winter within living memory." The well originally had a windmill engine, but is now served by a 1½ h.p. electric motor with an auxiliary 4 h.p. oil engine. The capacity of the storage tank, which is elevated to 10 feet, is 12,000 gallons ; the average daily consumption at the present is approximately 4,000 gallons. There are seven stand-pipes of the anti-freezing pattern, and thirty houses are connected to the main.

Castle Ashby. *Population* (1931), 236. *No. of houses*, 74.

Castle Ashby partakes of the private supply which is the property of the Marquess of Northampton ; the source consists of a well and springs, and the reservoir is fed by a ram with an auxiliary engine. Some houses are connected, and stand-pipes are also provided for the village.

Cogenhoe. *Population* (1931), 461. *No. of houses*, 143.

In 1900 the Medical Officer of Health of the District reported, " Not only is there no proper supply, but unsuccessful attempts have been made to obtain one, and I do not think it can be done except by a scheme for the whole village. There are 72 persons with no water within a reasonable distance." The village depends for its supply entirely on private wells apart from the two wells which serve the council houses.

Collingtree. *Population* (1931), 192. *No. of houses*, 58.

Collingtree also obtains its water entirely from private wells. The wells are shallow, sunk to a depth of 20 feet in pre-glacial sand. There appears to be a reasonable supply of water for this small village.

Courteenhall. *Population* (1931), 121. *No. of houses*, 33.

Courteenhall parish get their water mainly from wells which become deficient in quantity during a dry season ; the water is hard but of good quality. The supply from the twelve private wells is augmented by a stand-pipe connected with Sir Hereward Wake's reservoir. The house and surrounding buildings, and two outlying farms, get a limited quantity of water from a reservoir which is served by the Railway Company from their deep cutting. From the reservoir a pipe runs to a single stand-pipe in the village and serves the Rectory and eighteen cottages with drinking water. The wells are of a shallow type, deriving their water from pre-glacial sands at a depth of about 25 feet. The owner of the parish is endeavouring to develop a further supply for the village.

Rainwater is stored in large underground tanks at the house, at the School, the Rectory and all outlying farms, and is used (as the Women's Institute reports) " for other purposes than drinking, especially for animals—as it should be everywhere."

Denton. *Population* (1931), 424. *No. of houses*, 118.

In 1898 the District Medical Officer reported, " Whilst the lower part of the village is well supplied with water, some of the cottages in the upper part are very badly served." A good supply of water was found in 1899 at a depth of 70 feet, and a scheme was formulated for raising and conveying it to the village. A water scheme was installed in 1902 at a cost of £450, and originally served the top of the village only (one hundred people). It was pumped by a wind engine to a reservoir which served two stand-pipes.

The present scheme consists of a well 6 feet in diameter and 4½-inch brickwork, the upper 6 feet being cement jointed. The depth of the well is 63 feet and the average depth of water 4 feet ; it appears to be sunk through drift to great oolite limestone ; the water level has fallen as low as 18 inches, but no actual shortage has been recorded. The pump fixed to the well is a windmill engine, and an auxiliary 4½ h.p. engine has also been installed. The tank was constructed of 9-inch brickwork and surrounded by 6 inches of concrete ; it is built in three sections with concrete division walls ; its capacity is 30,000 gallons. There are six stand-pipes of the anti-freezing pattern fixed at different points in the village, and only eight houses are directly connected to the main. The daily average consumption at present is 4,500 gallons.

Hackleton. *Population* (1931), 378. *No. of houses*, 102.

There are two public wells in this village, one (at least) of which is unfit for drinking. These and the private wells are all shallow, deriving their supplies mainly from drift. The well at the new council houses is better constructed, and probably draws its water from the upper estuarine series.

Hardingstone. *Population* (1931), 704. *No. of houses*, 199.

The existing water supply was installed by the trustees of the present owner of the Delapre Estate in 1897, and consisted of a well of approximately 20 feet deep, which reaches to at least the upper layers of the ironstone, but does not penetrate as far as the upper lias clay. The original windmill engine was replaced in 1910 by a new pattern, and at a later date an auxiliary paraffin engine and pump was installed. The works therefore belong to different periods, but the reservoir and village mains have not been substantially altered since 1897.

The original well gave an insufficient yield and a new one was sunk a few yards away to tap the same spring ; this was done in March, 1902. At that time a yield of 8,000 gallons a day was obtained. The water is filtered through coarse roughing filters which help to remove suspended matters and deposits of iron. The service reservoir is of brick structure, with two chambers each 20 feet by 13 feet 9 inches by 7 feet deep, and the primary main to the village is only 2½ inches in diameter ; the pipes laid in the village are 2 inches. Pumping operations are now carried out by 1½ h.p. electric motor. There are approximately forty houses connected by internal pipes, and ten stand-pipes.

During the year 1933, there was an acute shortage of water, and it is evident that a permanent piped supply for this village is a matter of urgency.

Horton. *Population* (1931), 139. *No. of houses*, 32.

This little village is partially served by a private supply from the Estate ; a few houses are connected. Most of the cottages are dependent on shallow private wells.

Houghton, Great. *Population* (1931), 250. *No. of houses*, 78.

There are two public wells in the parish ; the one at the top of the hill being 55 feet deep and 5 feet in diameter, apparently deriving its supply from the great oolite. A trial well to a depth of 100 feet penetrated the ironstone beds and reached the upper lias clay, but very little water was found. The well at the bottom of the hill is only 9 feet deep and is probably fed by a spring from great oolite limestone. The Women's Institute reports that there are in the village eight indoor taps, one spring, five windlass wells and seventeen hand pumps, Twelve families have one well each ; the remainder are served as follows :

3 wells	—	2 families each.
4 ,,	—	3 ,, ,,
4 ,,	—	4 ,, ,,
1 ,,	—	5 ,,
1 ,,	—	10 ,,
1 ,,	—	17 ,,

It is stated that fifteen families have to go more than fifty yards for a water supply. The water is hard but not unpleasant. A number of the wells failed during 1933, but there has been no serious shortage.

Houghton, Little. *Population* (1931), 415. *No. of houses*, 130.

There is a piped private supply devised and carried out by Mr. C. Smyth in 1912. The source consists of two wells 35 feet deep and 4 feet 6 inches in diameter, lined with 4½-inch brickwork ; the walls are cement jointed to a depth of 20 feet and two headings have been driven to increase the supply. A 1½ h.p. engine and a windmill are fixed The storage tank, which has a capacity of 7,000 gallons, is elevated to a height of 10 feet. The main to the village is 3-inch cast-iron and approximately thirty-six houses are directly connected, twenty by internal pipes. There are three standpipes of the anti-freezing pattern. The average yield of the wells is 4,500 gallons per day. During the present drought the supply has been restricted and turned on only between 7 a.m. and 1 p.m.

About eighty houses are dependent on private wells which have shown signs of failure during the year.

There are two public wells in the parish with pumps fixed to serve the Council houses ; the rest of the village, as in 1900, derives its supply from private wells of which there are approximately forty-one.

Milton. *Population* (1931), 551. *No. of houses*, 144.

Milton has suffered in the past from the lack of a proper water supply. An outbreak of Enteric Fever in 1916 directed attention to the sanitary condition of the village, and the Surveyor reported with commendable caution that the sewers were not in the best of condition.

In 1926 the Ministry of Health suggested that the greatest need of the district was an adequate water supply, but the parish were disinclined to take any action ; what chiefly troubled them was not the impurity of the supply but the expense of getting a better one.

There are two public wells in the parish to-day, one of which in the centre of the village is 22 feet deep and 5 feet in diameter ; it has recently been lined with brickwork in cement and clay and domed on top to receive a sealed cover. A new pump has been provided, and the ground surrounding the well has been concreted and drained. There appears to be a good supply from this well. The other public well is very shallow and seriously liable to pollution. The parish has about twenty-six private wells, most of which are impure, and there is a risk that unless a piped supply is provided, the parish may sink more good money to get bad water. The Women's Institute report that twenty-two families have to go to the Town Pump, a distance of more than fifty yards, for their drinking water. Most of the private wells have pumps, but there is one windlass and bucket and in five cases buckets and poles are still used.

Piddington. *Population* (1931), 342. *No. of houses*, 104.

There are three public wells; the uppermost one is 20 feet deep, a stone well of 5 feet diameter and has a pump; there is generally 11 feet of water in this well; the walls are open jointed. The second well beside the butcher's shop is 12 feet deep, also of open jointed stone; the water level generally stands at 6 feet. The well is 4 feet 6 inches in diameter and it has a pump. The well beside the bakehouse is only 4 feet deep; it is stone lined and open jointed, 5 feet 6 inches in diameter. The private wells are all of similar construction. All these wells are liable to fail during dry periods and they are also exposed to gross pollution from the surface.

Preston Deanery. *Population* (1931), 103. *No. of houses*, 18.

The supply of this parish is entirely from shallow private wells; the deepest well is about 35 feet which just reaches the upper lias clay through boulder clay and sands.

Quinton. *Population* (1931), 92. *No. of houses*, 26.

There is one public well in this parish which appears to have an ample supply of water. There are also a number of private wells of the same type.

Roade. *Population* (1931), 701. *No. of houses*, 203.

The public well in this parish is 15 feet deep and in normal seasons 10 feet of water stand in it; the walls are of 4½-inch open jointed brickwork, and the well is 5 feet in diameter. The private wells are mostly polluted and there has been a grave shortage of water during the present drought. The Hardingstone Rural District Council have made many efforts during the past year to obtain a piped supply, and have spent a considerable sum of money on trial borings in the neighbourhood. It has not been possible, however, for various reasons to obtain a local supply, and it is doubtful whether the Hartwell Spring will be sufficient to serve both Ashton and Roade. The only hope for this village appears to be a piped supply from Northampton Corporation, and this has the advantage that Hardingstone, Wootton and possibly also Milton, Blisworth, Shutlanger and Stoke Bruerne could be served by means of a Regional Scheme. The present conditions are at any rate most unsatisfactory as regards both quality and quantity.

Rothersthorpe. *Population* (1931), 240. *No. of houses*, 64.

This parish is served mainly by private wells; there is one public well near the Church 11 feet 6 inches deep with an average depth of water of 4 feet 6 inches; the diameter is 3 feet 6 inches. This supply cannot be considered as satisfactory and it should be possible to include this village in a regional scheme.

Whiston. *Population* (1931), 49. *No. of houses*, 15.

This village has a private supply which serves a few houses and also a sufficient number of stand-pipes. The water is pumped from a spring in Whiston Spinney by means of a ram to a storage reservoir and serves the village by gravity. There are three stand-pipes, and a small number of houses are served by internal pipes.

Wootton. *Population* (1931), 621. *No. of houses*, 172.

This important village, in which considerable housing development is taking place, has four public wells and a generally unsatisfactory water supply:

No. 1. A brick well 12 feet in depth situated off Water Lane; the water level fluctuates considerably, but there is generally about 6 feet. The overflow from this well feeds No. 2 at the top of Water Lane; this is a stone well 12 feet in depth; it is rendered internally in cement and a cast-iron cover with a pump fixed; this well, together with the surplus from Well No. 1 is led downwards to feed two tanks at a lower level in the Lane; these tanks are provided with cast-iron covers and are raised above the ground level. The efficiency of these tanks is of course dependent entirely on the water level of the first well, and there has been a serious shortage during the present summer. No. 3, (Stockwell). This well has an ample supply of water ; it is 12 feet in depth lined with 4½-inch brick and 5 feet in diameter ; the water stands at 8 feet and is elevated by an ordinary pump ; this well also supplies a tank which serves the new Council houses and the adjoining properties.

No. 4, the well opposite Clare Terrace. The supply in this well has been maintained during the summer.

There is insufficient water in the two wells in Water Lane to feed the tanks, and the village has suffered a good deal from shortage ; there is an urgent need for a permanent piped supply.

Yardley Hastings. *Population* (1931), 796. *No. of houses*, 245.

As in the case of Whiston, the piped supply is owned by the Marquess of Northampton. The source is a well 5 feet in diameter and 62 feet deep, the walls of which are constructed of 4½-inch brickwork. The well is sunk through boulder clay to great oolite limestone. Water is raised by a windmill and an auxiliary engine to a storage tank of 20,000 gallons. There are ten stand-pipes in the village of the anti-freezing pattern. The school and the farms are directly connected with the main and also a few houses. There are in addition nine public wells in the parish ; they give varying supplies and are of doubtful quality.

KETTERING RURAL DISTRICT.

Barton Seagrave. *Population* (1931), 456. *No. of houses*, 124.

In the year 1908 a proposal was brought forward to link up Barton Seagrave with the water-supply from Weekley Well. At the present time fifty-one properties have a piped supply laid on from this source. The houses all lie adjacent to Warkton Lane and the main road (A6) along which the Burton Latimer main passes on its way from Warkton reservoir.

The bungalows on the lakeside are served by a piped supply from a local spring, but the remainder of the village is dependent on private wells. The Women's Institute reports that eighty-nine properties have wells averaging 25 feet deep. The water is hard, but the wells have maintained their level fairly well during the Summer.

Broughton. *Population* (1931), 1,207. *No. of houses*, 321.

Until recently, 320 premises derived their water from private wells, many of which were unsatisfactory. The need for a permanent piped service has been acutely felt, and it was necessary to delay the opening of a new school on account of lack of pure water.

The history of Broughton begins, as usual, with a request from the Parish in 1908 not to provide a water supply. In 1933 the parish was unanimously in favour of a scheme.

The scheme now introduced is a good example of the value of co-operation under the guidance of a Rural District Council.

The water supply already installed at Pytchley is to serve both parishes. The total estimated cost of the Broughton extension is £4,900. This includes a new electric pump at Pytchley, combined and service mains, and a concrete water tower of 30,000 gallons capacity at the highest point on the Northampton Road, which commands the whole village. The total annual (capital) charges are estimated at £299 14s. 0d. A 30 per cent. grant from the County Council, and a 10 per cent. grant from the District Council make a net annual loan charge on the parish of £179 14s. 0d. This makes no allowance for a grant from the Exchequer.

The maintenance costs are roughly assessed at :—

Electricity	£60
Wages	£50
Payment to Pytchley of three-quarters of the outstanding loan charges on the existing well ...	£38
	£148
Gross charge	£327 14 0.

The estimated water-revenue (based on an annual charge of 18/8 for an average Council house), assuming that 170 out of the 370 houses will be immediately connected is

	£158 13 4
Charge to school	£12 0 0
Total	£170 13 4

The net cost to the parish is equivalent to a rate of 11d, but this sum will be substantially reduced by

(*a*) the Government grant.

(*b*) the gradual connection of a large number of houses to the main.

Corby. *Population* (1931), 1,596. *No. of houses*, 406.

The story of water supply has a feeble beginning in 1902, when the parish announces that a scheme is unnecessary. Water is a highly controversial subject until 1908, when an application for a loan of £4,932 is finally put forward. The controversy appears to reach its height in 1908, when

> " This meeting of ratepayers, and householders of Corby, at their annual parish meeting, strongly protest against any interference of the District Council with the existing system of drainage and water supply of this village."

It is a pity (as Mr. Freestone of the Kettering Rural District Council once said) that we do not look forward twenty years. The Local Government Board Enquiry in 1914 met with determined opposition ; it was not until 1921 (after a delay largely due to the War) that a public-spirited offer by Mr. S. J. Lloyd made possible a supply which had so long been urged by the District Council.

In 1922 tenders for a total amount of £5,882 were accepted, and the water scheme was proceeded with.

The source of supply is a well sunk in the ironstone to a depth of 60 feet. The minimum yield is stated (1933) to be about 50,000 gallons a day. The water, which has a total hardness of 25.6° (temporary 18.2°) is of good quality, both chemically and bacteriologically. The water is pumped by a 7 h.p. oil engine to a reservoir of 50,000 gallons capacity.

Owing to the rapid growth of Corby in recent years, it became necessary to improve the water supply. The extensions to the system were estimated to cost £7,750 ; they included the provision of an elevated reinforced concrete tank of 120,000 gallons capacity with a top-water level of 440 O.D. ; a new electrically driven pump and engine ; and mains to the new housing estate.

I have dealt elsewhere with the more ambitious scheme of obtaining water from an impounding reservoir on the Eye Brook.

There is a piped supply laid on to about two-thirds of the old village, and all the new houses. About a hundred premises still derive their supplies from wells.

Cottingham. *Population* (1931), 555. *No. of houses*, 153.

There is a semi-private supply for a portion of the village, but eighty premises are dependent on wells. Unfortunately the cottages, including the Council houses situated at the top of the hill, have been very short of water. It has been necessary to deliver supplies by means of a water-cart.

Cranford. *Population* (1931), 381. *No. of houses*, 105.

In the early years of the century the District Council made a brave effort to find water for the Cranfords. The parishioners pointed out that they suffered no inconvenience from the lack of water, but in spite of this, Beeby Thompson was instructed to prepare a scheme. He recommended the sinking of a well some 500 yards to the north of St. Andrew Rectory, and estimated that water would be found in the ironstone at a depth of 90 feet. His scheme included the provision of a wind-pump, a reservoir 30 feet in height with a capacity of 30,000 gallons, and a 3-inch main to feed twelve stand-pipes and six hydrants. The estimated cost was £1,540, excluding land and easements. For one reason and another the scheme did not materialise, and to-day the Cranfords still rely on wells, which serve about 112 premises.

A scheme for a piped supply is once more under consideration, and it may be found desirable to extend a main either from Kettering via Barton Seagrave, or from Woodford.

Cransley. *Population* (1931), 296. *No. of houses*, 84.

There is one public well in the centre of the village, and two on the Council Housing site. About seventy-seven premises derive their supply from these, and ten privately owned wells. Four of the latter gave out during the year, and the general position is unsatisfactory.

East Carlton. *Population* (1931), 61. *No. of houses*, 19.

There is at present no public supply for this village, but arrangements will be made for a piped service to the new estate. Four larger houses have a piped supply from a spring and ram. Information from the Women's Institute states that fourteen cottages are supplied by a spring and ram, but no water is actually laid on. There is one standpipe. The water is of good quality but very hard. There is abundant water in the parish.

Geddington. *Population* (1931), 995. *No. of houses*, 273.

This village has no piped supply ; 250 premises obtain their water from shallow wells. There are four public supplies—two wells, the famous covered spring under the cross, and one adjoining the chapel in Queen Street. The wells on the Council Housing Estate are deeper than the average (35 feet). There is no scarcity of clear water in the village, and the parish has in fact assisted its neighbour, Grafton Underwood, during the drought.

Grafton Underwood. *Population* (1931), 180. *No. of houses*, 48

There is a piped supply to a few houses owned by the Duke of Buccleuch, which also serves three standpipes. The supply comes by gravity from a small reservoir a quarter of a mile north of the village. About fifty premises are dependent on shallow wells. There has been a serious shortage in all supplies.

The Rural District Council have under consideration a piped supply for Grafton in conjunction with Cranford.

Harrington. *Population* (1931), 140. *No. of houses*, 44.

There is no piped supply in Harrington and forty-nine premises obtain water from private wells. There is a very good spring within a short distance of the village with a flow of 12,000 gallons a day during August, 1933. It should not be a difficult matter to instal a piped supply to meet all the requirements of the village.

Loddington. *Population* (1931), 307. *No. of houses*, 82.

Loddington has no public supply. Sixty premises derive their supply from wells, and twenty from other sources. Three shallow wells are kept in repair by the Local Authority ; one of these failed during the Summer.

Middleton. *Population* (1931), 272. *No. of houses*, 78.

Middleton, like Cottingham, has a small piped supply owned by the copyholders. Forty premises derive their water from wells, and forty-two from springs. There is no shortage of water in the neighbourhood, and it should be possible to organise a proper supply to the whole village.

Oakley. *Population* (1931), 274. *No. of houses*, 70.

Great and Little Oakley have no piped supply, and the villagers are dependent on private wells and springs.

At Great Oakley, the Women's Institute Report states that every house collects its own soft water for washing. The wells are labelled according to whether they are fit for drinking. For drinking water there are twenty-five houses, the school, and the institute to two wells in the top half of the village, and in the lower half six houses are served by a pump. The two drinking wells have dipping buckets ; and there are for other supplies four pumps and a tap. The wells are shallow (ironstone) and the water is clear, cold and very hard.

Little Oakley has an unfailing spring which is being used to augment the water supply of the steel-works at Corby.

Pytchley. *Population* (1931), 531. *No. of houses,* 142.

This village was one of the pioneers of water supply in Northamptonshire. The original scheme was prepared in 1900 by Beeby Thompson at an estimated cost of £1,200. The source was a well in the Northampton Sand to the north-west of the parish, from which the water was pumped by wind-power to an elevated tank of 20,000 gallons.

The parish council were opposed to the scheme and put forward many dilatory pleas, but fortunately the zeal of the Rural District Council prevailed. A plentiful supply of water was found at 50 feet, and the service was begun in 1902.

At the present time there is a piped supply to the village : the greater portion of the houses are directly connected, but there are also a number of stand-pipes. There are now two wells with electrically driven pumps, and a windmill still attached to the older well. The quality of the water is good, but hard. The reservoir has 35,000 gallons capacity, with a draw-off level of 380 O.D. The new well, sunk in 1930 is 74 feet deep, and has a diameter of 3 feet 6 inches.

Rushton. *Population* (1931), 413. *No. of houses,* 110.

A scheme of water supply was installed in 1911, through the generosity of Mr. Clark Thornhill.

The well, (which is now the property of Messrs. G. & D. W. Pain) is equipped with a 2½ h.p. oil engine and pump, with 2-inch delivery. The water is pumped to a reservoir of 10,800 gallons capacity, with a draw-off level of 361 feet. The rest level of the well is 265 O.D. The service, which has withstood the drought so far, is piped partly into houses, and partly to standards.

Stanion. *Population* (1931), 300. *No. of houses,* 76.

This parish enters water-history in 1902, with an outbreak of grave infectious disease, apparently resembling the " Raunds illness " of 1894. The parish decide to clean out the wells, which are heavily polluted. In 1904, on the advice of Beeby Thompson, a water scheme is brought forward at a cost of £800. Apparently the Local Government Board fail to recognise the genius of Beeby Thompson, for they demand the services of a geological expert ! In 1906 a scheme is sanctioned at a cost of £1,440.

Stanion now has a water supply to which the larger houses are connected, while the cottages are served by stand-pipes. The water is good in quality, but hard. The average yield of the well is said to be 50,000 gallons, but apparently the daily consumption is only 5,000.

Water is delivered to a reservoir of 30,000 gallons capacity by a wind-engine and pump, with a 3½ h.p. oil engine and pump as a stand-by. The draw-off level of the reservoir is 301 O.D. and the rest level of the well is 207 O.D.

Thorpe Malsor. *Population* (1931), 142. *No. of houses,* 40.

Thorpe Malsor is in the fortunate position of having a priority claim on the water resources of Kettering Urban District, as the reservoir is in Thorpe parish. Some houses are served by internal pipes, and the remainder by stand-pipes.

Warkton. *Population* (1931), 199. *No. of houses,* 55.
Weekley. *Population* (1931), 241. *No. of houses,* 54.

The villages of Warkton and Weekley also obtain their water from the Burton Latimer reservoir, which is in Warkton parish. A free supply to these villages was a condition precedent to the purchase of the Weekley well, and this condition was retained when Kettering R.D.C. purchased the undertaking from the Urban District Council. The Urban District Council of Burton Latimer is now the owner of the system.

Unfortunately the well at Weekley has not held out during the drought, and the supply has been seriously curtailed, in spite of a supplementary service from Kettering Urban District. Both Kettering and Burton Latimer are anxiously seeking to augment their supplies.

Weldon. *Population* (1931), 811. *No. of houses*, 222.

Great and Little Weldon have no piped supply, but there appears to be abundant water in the wells.

The Surveyor of Kettering Rural District Council has put forward interesting suggestions for linking water-supplies in the area in such a way as to cover the most important villages. The principal groups are :—

(1) Kettering, Burton Latimer, Weekley, Warkton, and Barton Seagrave.

(2) Pytchley, Broughton and Cransley, from the Pytchley well. This scheme already includes Broughton.

(3) Corby, Weldon : the latter villages could be served by gravity from Corby.

(4) Cranford, Grafton Underwood.

(5) Geddington, Newton, Oakley : the fine spring at Little Oakley could ultimately be harnessed for this supply.

(6) Harrington and Loddington, either from independent springs or by Kettering Urban District.

MIDDLETON CHENEY RURAL DISTRICT.

Appletree. *Population* (1931), 92. *No. of houses*, 18.

This hamlet consists of eight cottages and a few scattered dwellings. There is one public well for the eight cottages and the remainder have their own private wells.

Aston-le-Walls. *Population* (1931), 101. . *No. of houses*, 23.

There is a private piped supply owned by Mr. North.

The source is a spring about half a mile away from the village situated in Long Hill Field ; the water flows into a 5,000 gallon storage tank and is then conveyed by a main to one stand-pipe and to four houses to which the water is laid on.

This installation was made in 1922 and cost £500.

Chacombe. *Population* (1931), 274. *No. of houses*, 74.

With the exception of one large residence and Chacombe Priory, each of which has its own private water supply, this village obtains the bulk of its water from two springs : (1) Lion's Head Spring, situated on the Middleton Cheney—Chacombe Road ; this spring has never failed. (2) A spring situated in Berry's Close.

There are several private wells but these are mostly unsafe for domestic use.

A Public piped supply scheme is under consideration to instal an automatic electric pump at the spring in Berry's Close, service tank and mains to five stand-pipes in the village.

Chipping Warden. *Population* (1931), 298. *No. of houses*, 90.

There is a Private piped supply laid on to three premises in this parish. The remainder obtain their water from one public well and a number of private wells.

The wells are unsatisfactory both in quantity (several have failed recently) and quality.

For the private supply the source is a spring situated on the corner of Culworth—Chipping Warden Road ; the water is pumped by a ram to two storage tanks each 5,000 gallons capacity, from which there is a piped gravity feed to the three premises; the installation cost £600.

There has been insufficient water to work the ram this year and an engine-driven pump has been installed to obtain full benefit from available source. The entire cost was approximately £600.

Lower Boddington. *Population* (1931), 127. *No. of houses*, 42.

This parish has a public supply of water which is laid on to twelve farms and to four stand-pipes for the use of the remaining houses. The source of water is a spring called " Malgow " situated on Mr. Phipps' farm.

There is a small collecting tank at the spring from which a main is laid to a service tank situated in the village.

This water supply is not satisfactory; shortage has occurred before 1930 and in the years of drought since 1930 the shortage has been more acute. The installation of the public supply was in 1890. Many of the private wells in this region are dry.

Upper Boddington. *Population* (1931), 198. *No. of houses*, 67.

The water for this parish is obtained entirely from wells of which there are three Public and many private wells ; several of the latter are dry at the present time.

An opinion was expressed to the effect that there was an available source of water beneath " Pingle Field " and expert opinion is being sought with regard to this situation as a source for a public supply.

Middleton Cheney. *Population* (1931), 1,131. *No. of houses*, 290.

The parish obtains its water supply entirely from private wells, of which there are approximately sixty.

A few wells are dry at present and 1934 is the first year that any well has been known to fail.

Attempts have been made to find a suitable and adequate source of water to use as a public supply to this parish. Water diviners have been employed, but owing to their divided opinions progress has been hindered.

A committee has been formed which is ready to consider any possible scheme.

Overthorpe.

The existing supply for this hamlet comes from a well sunk three years ago to a depth of 53 feet near Warkworth Church. A wind engine lifts the water to a tank on a brick tower at Overthorpe, and there is an auxiliary electric engine. This well, which at first yielded 1,500 gallons an hour, is now dry.

Overthorpe stands on the middle lias clay, and the local wells draw water from the marlstone, which appears to be thin and poorly supplied.

The consulting engineer recommends the utilisation of a spring in Warkworth village which, during 1934, had a yield of 7,000 gallons a day—sufficient for both Overthorpe and Warkworth.

Warkworth. *Population* (1931), 44. *No. of houses*, 10.

This hamlet is dependent on private wells for its water supply, several of which have failed recently.

One house has water laid on, the source being a spring ; there is a small service tank and water main to the house.

A suggested source of water is a spring in " Pucklow Field " ; this spring has never been known to fail, the amount flowing is equivalent to a full delivery from a 1-inch bore pipe.

NORTHAMPTON RURAL DISTRICT.

Bugbrooke. *Population* (1931), 826. *No. of houses*, 224.

This village has no public piped supply, and its inhabitants are mainly dependent for their water on shallow wells Many of these must necessarily be polluted.

It is clear that a public supply is essential, but the District Council no doubt consider it desirable to wait until it can be determined whether Kislingbury or Harpole is the better source.

Duston. *Population* (1931), 2,095. *No. of houses*, 576.

This large and growing village profited by one or two severe lessons, and has now an almost complete piped supply from Northampton Corporation. A number of cases of enteric fever between 1898 and 1904 helped to promote the first supply from the borough ; and a sharp outbreak of twenty-two cases in New Duston in 1914 led to the closure of nearly all the remaining shallow wells. In the latter epidemic the organism of Enteric Fever was actually isolated from the water of a well near the school.

The village is served by the Northampton Corporation, through a service reservoir of 140,000 gallons capacity situate within the parish.

The original cost of providing the water in 1905 was £3,500. No loan is now outstanding.

The present cost of pumping is approximately £150 per annum for which an annual rate of 6d. is required ; in addition, the Corporation levy a direct rate of 15 per cent. on the rateable value of all property connected.

The total quantity of water available is adequate, but although the service reservoir is on the highest ground, the pressure near to it is insufficient and eventually steps will have to be taken to remedy this.

A number of houses situate on the Weedon Road still rely on wells, which should be superseded by the public supply.

Billing. *Population* (1931), 311. *No. of houses*, 90.

Great Billing. The water supply in this village has never been satisfactory. The recommendation of the Local Government Board, after the epidemic of 1912, that the Northampton Borough supply should be installed, has not yet been acted upon.

There is to-day only one public well, fitted with a hand pump. It is shallow—probably derived from Northampton Sand. The private wells have barely held their own.

Little Billing. *Population* (1931), 83. *No. of houses*, 22.

This hamlet has a private piped supply from Billing Arbour : the water is pumped from there by a ram to a reservoir of 2,000 gallons capacity on high ground, and thence by gravitation to the village.

There appears to be ample water of fair quality, and an electric main is close at hand. This supply is probably sufficient for both villages, and could be installed at a reasonable cost. Failing this, the Northampton Corporation supply is readily available.

Harpole. *Population* (1931), 830. *No. of houses*, 225.

Apart from two private piped supplies from Northampton Sand wells, north of the village, and which have fallen very low, the village relies on private wells ; these have kept up fairly well—all being in the middle lias and varying in depth with the O.D. level.

However, a public water scheme has been approved by the District Council, estimated to cost £3,350. The Ministry of Health have sanctioned the loan, and subject to certain conditions have made a grant of £550. One condition is that the County Council also make a contribution under the provisions of the Local Government Act, 1929, Section 57, and the other is that a charge ot 10 per cent. of the rateable value is levied on all property connected.

The scheme itself provides for a bore-hole situated north of the village. A 14-days pumping test shows an output of 47,000 gallons per day from a 10-inch bore-hole. The analysis, however, is not quite satisfactory, and the Ministry of Health insist on the water being sterilized. Tenders have been advertised for, and the work will shortly be put in hand.

Kislingbury. *Population* (1931), 670. *No. of houses*, 186.

This village has an excellent fully piped supply. The source is from deep springs outcropping from the Northampton Sands a little over a mile north of the village.

It is a District Council supply ; non-statutory ; installed in the late 1890's at a cost of £2,200.

The supply is ample—total yield of spring approximately 25,000 gallons per 24 hours, (Dec. 1933), and I have been told that some 30 years ago the yield was gauged at 24,000 gallons per 24 hours after a spell of three dry years.

Chemical analysis :—" Exceptional organic purity. No Nitrites or free ammonia. Total hardness 23°. Chlorine 1.5 grains per Imperial Gallon," (30.11.32).

The gathering ground is supposed to be the outcrop of Northampton Sands near Althorp Park at about 400 O.D.

There is a collecting well 5 feet deep ; ground O.D. level 272 feet, with an underground brick reservoir of 20,000 gallons capacity. Top water O.D. level 268.66 feet ; bottom water O.D. level 262.50 feet ; highest point in village about 237 O.D.

No filtration is carried out, and the constant supply is by gravitation, although, as will be seen from the levels and distances traversed, the pressure at the high part of the village is not great.

The population being supplied is about 650.

There are eight standpipes in the village, but no fire hydrants.

The total daily consumption for all purposes is between 7,000 and 9,000 gallons.

No loans are outstanding, the maintenance charges being £30 with income at about £60 per annum. Charges are by tap rent 4/- for first and 2/6 each for subsequent ones, and bulk supply through meter at 1/6 per 1,000 gallons.

Lower Heyford. *Population* (1931), 686. *No. of houses*, 179.

In 1921 there was an acute shortage of water, especially on the west side of the green. " The inhabitants were lucky to get one bucket a day, and even that was only forthcoming if drawn early in the morning." The Surveyor recommended a scheme of supply at that time, but it has not been carried out.

This village has individual wells and two private piped supplies from springs outcropping at the junction of the middle with the lower lias, along a geological fault line—east to west—running parallel with the river Nene on the south side.

The private supplies lead to standpipes in the village (five).

Although the yield of the springs is ample, there is no useful or reserve storage capacity.

An annual payment of £18 is made by the Parish to the owners and the income is 2/6.

By quite a relatively small expenditure of money an excellent scheme could be made.

Upper Heyford. *Population* (1931), 109. *No. of houses*, 28.

This hamlet obtains its supply partly from individual wells and partly from a private piped supply which has its source in a deep well in the middle lias. " Satisfactory so far as it goes."

Weston Favell. *Population* (1931), 4,066. *No. of houses*, 956.

This village is adequately supplied by direct connection with Northampton mains, and pipes are laid on to all houses.

" We, the inhabitants of Weston Favell, most strongly protest against the proposed supply of water. We are quite satisfied with our present supply. We never have an epidemic, unless it is imported from another locality : and as a rule the inhabitants die of old age. Therefore we consider it an injustice to have a burden thrust upon us for the fad of one person." (1908).

I wonder how many of the inhabitants would subscribe to that resolution to-day, and return to the régime of shallow well, bucket, and privy.

OUNDLE RURAL DISTRICT.

Apethorpe. *Population* (1931), 200. *No. of houses,* 50.

The original supply to the Apethorpe Estate was from a spring in the limestone, situated in field 23 in the Parish of Kings Cliffe, on the west side of the Willow Brook. This spring has proved very satisfactory for a considerable number of years, but this Summer it began to show signs of giving out, and at the present moment it is completely dry.

At the present time, there are two sources of supply which are being utilised :—

(*a*) A spring which runs out near the drift road just below field number 23, and has a capacity of approximately 30,000 gallons per 24 hours. This water is taken by means of a ram to the pumping station which is situated in field number 103.

(*b*) The other source is from a spring on the east side of the Willow Brook, in field number 112.

This spring comes from where the Lincolnshire limestone outcrops. Actually there are seven springs, shown on the old Award Map.

These springs are now collected in one chamber, and taken to the pumping station, referred to above, and situated in field number 103. The capacity of this spring is at present approximately 120,000 gallons per 24 hours.

The water is pumped from the Pumping Station in field 103 to a reservoir situated on the high ground on the Spa Farm. There are two 6 h.p. electric pumps, the electricity being supplied from the Apethorpe Estate private supply. There is one auxiliary oil engine. There are also two pumps which are each capable of pumping 2,000 gallons per hour.

Normally one pump is used, and it draws the water from the spring at Seven Wells, but if a considerable amount of water has been taken out of the reservoir during the week-end, additional water is obtained from the ram source, and both pumps can then be used for a limited time.

The capacity of the storage reservoir is 150,000 gallons.

The following is a list of the houses in Apethorpe which are supplied by pipelines to sinks, etc. :—

(*a*) Apethorpe Hall, Odd Man's cottage, Gardener's house, Grooms' rooms over Stables, Stud-groom's cottage. All these have baths and sinks. The Lodge cottage has pipes supplying the sink.

(*b*) Manor House, which of course has baths and sinks. Cottage in the Manor House yard, which also has baths and sinks.

(*c*) The following in the village have baths and sinks :— The Estate Office and Cottage adjoining, Mrs. Fletcher's House, Butler's Cottage, Head Cowman's cottage, three Terrace Cottages, " King's Head Inn," T. Major's cottage.

In addition to this, there are fifteen cottages with pipe supplies to sinks.

(*d*) Willow Brook Farmhouse, Manor Farm and Dairy Farm buildings, and there are a number of fields which are watered off this supply.

(*e*) There are two cottages known as the Quarry Cottages which obtain their water from this supply. These are actually in the Parish of Kings Cliffe and consequently they should, strictly speaking be included in the Kings Cliffe supply.

There is one standpipe in the village supplying three cottages. With regard to the remainder of the property, the Spa Farmhouse and the buildings and cottages draw their water from the main supply. They are, however, on higher ground, and there is a windmill at the reservoir from which the water is pumped to the Spa Farm.

There is storage at the Spa Farm for approximately 3,000 gallons of water.

The two other principal farms on the Estate are the Lodge Farm, together with the house and cottages, and Bluefield Farm, together with the house and cottages. Both these farms are watered by independent supplies from separate springs, and they both have had very adequate supplies during the whole of this Summer.

Armston. *Population* (1931), 28. *No. of houses*, 7.

This hamlet has no piped supply. Six premises derive their water from shallow wells.

Ashton. *Population* (1931), 188. *No. of houses*, 48.

Ashton has a private supply owned by the Rothschild Estate. Water is pumped by a turbine and oil engine from a shallow well in the river gravel of the Nene. It is conserved in a storage reservoir of 30,000 gallons and treated by chlorination. Approximately forty-one premises are supplied by internal pipes. There are five private wells serving nine houses. No shortage of water has occurred during 1933.

Barnwell. *Population* (1931), 293. *No. of houses*, 85.

The Barnwell villages have no public supply, and are dependent upon shallow wells in the valley gravel and drift, many of which are exposed to surface pollution. There are nineteen closed and twenty-one open wells, serving ninety-two premises. No serious shortage has been reported, but the supply is generally unsatisfactory. The five public wells share the general liability to pollution.

Benefield. *Population* (1931), 343. *No. of houses*, 100.

Benefield, which rests on an outlier of Oxford Clay, is supplied partly by the reservoir on the Biggin Estate. The source is a spring issuing from Lincolnshire Limestone. Water is pumped by an oil engine to a reservoir of 24,000 gallons, and fed to the village by gravity. Twenty houses have a supply laid on and the remainder are served by twelve standpipes. The water passes through a filter of gravel and charcoal. The remainder of the village is dependent on shallow private wells.

This scheme appears to serve the needs of the village, and no shortage is reported.

Blatherwycke. *Population* (1931), 92. *No. of houses*, 27.

Blatherwycke has two public wells fed by a spring. Both are shallow and exposed to surface pollution. About twenty-two premises are served. There are also four private wells supplying six houses. The fine lake, which has recently been dredged, is intended to serve as a reserve supply for the steel works at Corby.

Bulwick. *Population* (1931), 201. *No. of houses*, 58.

This village is partly supplied from a spring which serves the Estate. The water is pumped by a hydraulic ram to a tank of 4,000 gallons capacity. Four houses have the supply laid on, and about half the village is served by two stand-pipes in the street. Four houses have taps in their yards. The source of this supply and of the wells is Lincolnshire Limestone. The quantity is ample. There is also one public well, and a dipping spring, supplying about thirteen houses. The water is very hard, but always clear and cool.

Cotterstock. *Population* (1931), 117. *No. of houses*, 34.

Cotterstock has no public supplies. There are some twenty private wells serving thirty-five houses. Shortage of water has been reported in 1933, but actual famine cannot occur because the river runs close to the village.

Deene. *Population* (1931), 135. *No. of houses*, 38.

Deene has three shallow public wells, supplying twenty-six houses, and ten private wells for seventeen houses. The source is apparently superficial limestone.

Deenethorpe. *Population* (1931), 85. *No. of houses*, 28.

Deenethorpe has two public wells to serve twenty-three houses. The remaining cottages are served by seven private wells. These wells are shallow, and draw water from the Lincolnshire Limestone.

Fotheringhay. *Population* (1931), 213. *No. of houses*, 53.

Fotheringhay has one public well, and some twenty-three private wells, the former serving six, and the latter forty-seven houses. All the wells are shallow holes in the river gravel. There is no shortage, but the quality is doubtful.

Glapthorne. *Population* (1931), 223. *No. of houses*, 65.

Glapthorne has two roadside dipping-wells for public use. About thirty premises are served. Forty premises obtain their water from thirty-six private wells and two springs. The water is derived from the limestone, and the wells are readily polluted by surface drainage. No shortage has been reported.

Hemington. *Population* (1931), 122. *No. of houses*, 28.

Hemington lies on the Oxford Clay east of the Nene. Like its neighbours it has no real water supply at all. There are two public tanks which collect surface water for fifteen houses. The remaining sixteen houses are also dependent on superficial dip-holes.

The water is impure and wholly insufficient, even in an average year.

This village is included in the regional supply scheme brought forward by the District Council ; but until that scheme is executed, " all we can do for Hemington," as Mr. Weigall said in 1905, " is to sympathise with the inhabitants and pray for rain."

Kings Cliffe. *Population* (1931), 884. *No. of houses*, 249.

The Local Government Board asked for plans for a water supply in 1897, on the ground that many wells were unfit, and that water-carrying was undesirable.

The story of Kings Cliffe water begins on a cheerful note in 1900, when "The Chairman of the Committee . . . recommended a reservoir at the top end of Bull's furlong, where they found a plentiful supply of water, and the fall would be sufficient to cover the whole village. There would be no labour, no pumping, and no rent."

Unfortunately the dream was shattered, for the engineer reported that it was impossible to obtain a supply by gravitation. He recommended a supply from the " Bee " well. An enquiry by the Local Government Board was held in 1901 with regard to a proposed loan of £1,000 to defray the cost of experimental borings.

A parish meeting was held to consider the water supply, and a motion was carried without dissent, condemning the waste and uselessness of spending between £3,000 and £4,000 on a scheme.

At the same time Dr. Elliott, the Medical Officer of Health, submitted a detailed report, showing that many of the wells in the village were dangerously polluted. In spite of this, however, the whole question seems to have been allowed to drop.

A further scheme, estimated to cost £1,300 was brought forward in 1908, and plans and estimates were submitted to the Local Government Board. In 1910 the Parish Council resolved that the proposed water scheme was unnecessary. The District Council took the matter in hand and an enquiry was eventually held in 1912, regarding a proposed loan of £1,350.

In the same year the difficulties of Kings Cliffe were resolved by a splendid offer from Mr. Leonard Brassey to supply the village from his new reservoir at a greatly reduced cost, estimated at £932 instead of a probable £2,000. The reservoir would hold 150,000 gallons, and for a minimum rental of £72 annually, Kings Cliffe could have a daily supply of 5,000 gallons free, and any quantity above that amount for 5d. per 1,000 gallons. The only capital cost to the parish was the laying of a main from the reservoir, at an estimated cost of £850. The necessary loan was sanctioned in 1913, and the supply was turned on in the following year.

The existing water supply, for which the Local Authority is responsible, is laid on to a hundred houses There are seventeen stand-pipes which serve the greater part of the village (247 houses). The remaining houses, approximately nineteen, rely on a dipping-spring, and some eleven private wells deriving their water from the limestone.

Lilford-cum-Wigsthorpe. *Population* (1931), 144. *No. of houses*, 39.

Lilford-cum-Wigsthorpe has a private supply, owned by the Lilford Estate. The water is obtained from the River Nene, and filtered through gravel, carbon, and white sand. The water is pumped by a turbine to a reservoir of 300,000 gallons. There are no stand-pipes, and twenty-two premises have the water laid on.

There are also eleven private wells serving nineteen properties at Wigsthorpe.

Luddington and Lutton. *Population* (1931), 170. *No. of houses*, 46.

These little villages, like Hemington, lie on the Oxford Clay, and are practically waterless in dry weather. Luddington has seven, and Lutton seventeen surface wells.

Nassington. *Population* (1931), 491. *No. of houses*, 138.

Nassington has three shallow dipping-wells, spring-fed, for public use. About thirty-two houses are served. There are some sixty-seven private wells to supply 114 houses. These wells are shallow and owe their water to fissures in the limestone.

Pilton. *Population* (1931), 75. *No. of houses*, 22.

Pilton has a public supply from a spring owned by the Lilford Estate. The water is filtered through gravel and charcoal, and feeds two standpipes. Three houses have the water laid on. There are also ten private wells supplying fourteen premises. The quality of the water is very doubtful.

Polebrook. *Population* (1931), 315. *No. of houses*, 80.

Polebrook, which lies on the edge of the Oxford Clay, has three shallow public wells. The first and second, provided with a windlass and bucket, serve ten and seven houses respectively. The third, with a fixed pump, is used by forty-three households. There are also some fifteen private wells, serving eighteen premises.

Serious shortage of water was reported in 1922, and again in 1930-31. The position has been serious during the present drought, and the District Council have included this village in their regional scheme.

Southwick. *Population* (1931), 171. *No. of houses*, 43.

There are three shallow wells, owned by the Estate, for public use. The number of premises served is four, eight and five. In addition twenty-two private wells are in use for twenty-nine households. The water is derived from Lincolnshire Limestone at no great depth.

Stoke Doyle. *Population* (1931), 96. *No. of houses*, 25.

Stoke Doyle has one shallow well for public use, which serves twenty-two houses. Five houses have each a private well. No shortage has been reported.

Tansor. *Population* (1931), 176. *No. of houses*, 49.

Tansor has one spring-fed well, which supplies ten houses. The remaining forty-one premises are dependent on private wells (17). These wells are mostly in the river gravel, so that the quantity at least is good.

Thorpe Achurch. *Population* (1931), 148. *No. of houses*, 47.

Thorpe Achurch has two public wells, a shallow dip-well, and a fairly deep well fitted with a pump. There are also twenty-one private wells, used by thirty-five families. The deeper wells obtain their water from the Lincolnshire Limestone.

Thurning. *Population* (1931), 102. *No. of houses*, 32.

Thurning, like the other villages on the Oxford Clay, lives precariously on pond and other surface waters. A detailed report on the water-problems of the village was presented by Dr. Elliott in 1916. It is interesting to note that he foresaw the possibility of the regional scheme which is now brought forward by the District Council. A trial hole 20 feet deep was made in 1916, but the water was useless. Deep borings through the Oxford Clay produced a limited supply of brackish water.

Wadenhoe. *Population* (1931), 132. *No. of houses*, 45.

Wadenhoe has one shallow well, with a pump, for public use. About ten properties are served. There are also ten private wells (five with pumps) used by thirty households. A spring belonging to the Estate is piped to a 30,000 gallon tank, and water is laid on from there to six houses.

Warmington. *Population* (1931), 517. *No. oj houses*, 146.

Warmington stands on a shallow " saucer " filled with valley gravel. There are two public wells, fitted with windlass and bucket, used by ten and three households, respectively. The Women's Institute reports that there are seventy-one wells, fifty fitted with pumps, ten with windlass, and eleven dipping-wells Four houses use rain water. 151 houses use these shallow gravel supplies, and there can be little doubt from the nature of the subsoil, that many of them are liable to pollution.

Woodnewton. *Population* (1931), 255. *No. oj houses*, 71.

Part of the village—thirteen houses—has a piped supply laid on from the Apethorpe Estate ; and I can see no valid reason why the whole village should not have the benefit of this excellent service. The forty private wells which serve as a supply for the remainder of the village are either manifestly unfit, or liable to gross pollution. The time has arrived when the inertia or the opposition of the parish should be overcome.

Yarwell. *Population* (1931), 248. *No. of houses*, 69.

There is no public supply to this village.

Seventy-one premises derive supply from shallow wells, and two from a spring issuing from the limestone.

OXENDON RURAL DISTRICT.

Arthingworth. *Population* (1931), 165. *No. of houses*, 49.

There are no public wells in this parish ; a well and pump adjoining the highway supplies cottages on the Harrington Road. A small reservoir with a tap supplies the cottages at the north end of the village. In addition to the private supplies of the seven houses there are thirteen wells for the use of the cottagers. Arthingworth lies on the upper lias clay, and the wells are fed almost entirely with surface water. A boring of 78 feet met with two thin rock beds between 70 feet and the bottom of the boring, and a small quantity of water was found. These beds were possibly marlstone which is a very uncertain rock in this district.

Ashley. *Population* (1931), 182. *No. of houses*, 53.

Ashley has one public well and pump at the east end of the village. The well is 28 feet deep in the upper lias clay. On private property there are twenty-one wells of the same type. A drinking trough at the east end of the village is fed by a spring which appears to give an ample supply. No shortage has been reported.

Brampton Ash. *Population* (1931), 130. *No. of houses*, 33.

Brampton Ash is owned by one landlord and private wells appear to be quite sufficient for the hamlet. The springs are derived from Northampton sand as it emerges beneath overlying boulder clay. Most of the wells are about 20 feet deep and penetrate the upper lias clay through the Northampton sand.

Braybrooke. *Population* (1931), 282. *No. of houses*, 77.

There are three public wells with pumps in this parish : (1) Arthingworth Road with a constant supply ; (2) near Mr. Ward's house—this supply often fails ; (3) opposite the Council Houses—the supply from this well is variable and contains a considerable quantity of iron. The two housing schemes set up by the Council have a good and constant supply. About thirty-six private houses have their own wells. No shortage has been reported.

Clipston. *Population* (1931), 408. *No. of houses*, 134.

There are three public pumps in this village, two of which failed during the drought of Summer, 1934. The two groups of Council houses have three wells, two of which failed during the same period, necessitating the digging of another well. An enquiry gives records of thirty-nine private wells of which twenty-eight are said to be fit for drinking. The water from all of these wells is very hard. Some houses, including the new council houses, have rain-water tanks built in the ground with pumps fitted indoors.

The well in the centre of the village by the school has never been known to run dry, although the number of families dependent on it increased when other wells in the village failed. Even in normal times many families have to carry water long distances, but in times of drought, conditions are very much worse.

The village has a drainage scheme with septic tank which causes a nuisance at intervals. A piped water scheme for this village is desirable. It may be noted that at a meeting of the Parish Council in December, 1904, it was resolved that " it was not advisable to contribute towards the proposed steam fire engine at Market Harborough as it would be of no use at Clipston owing to the scarcity of water. A discussion subsequently took place on the insufficiency of the water supply but nothing was done."

East Farndon. *Population* (1931), 236. *No. of houses*, 60.

East Farndon has no public piped water supply. There are, however, two public pumps—(*a*) at the southern end of the village, and (*b*) against the Cottage Home. There is also a spring which conveys water in a 3-inch pipe to the lower end of the village with a flow of about 3,000 gallons a day. Each of the two housing estates has a well and pump. There are some twenty-two private wells and pumps. In addition to the public supplies referred to above, there is a private piped supply from a deep well on the high ground south of the village ; the water is pumped into a reservoir and thence led along by a pipe to another tank which serves Farndon Hall, the Manor House and some other buildings. The tank above Farndon Hall has an auxiliary supply from a spring ; the water is good in quality but very hard. This supply failed in November, 1933, and again in the spring of 1934. It was necessary to cart 1,000 gallons a day from the public spring at the lower end of the village in order to maintain the level in the reservoir tank. There appears to be a good supply of water in the area, but the majority of the villagers go for their drinking water to one or other of the three public supplies, especially the spring at the lower end of the village. Several families rely on these sources for their entire supply. Rain water is stored in varying quantities, but never in sufficient amount to form a complete supply. The wells, with few exceptions, are about 25 feet in depth, and provide hard water which, in the south end of the village at least, is liable to pollution from the surface. The only properties which are definitely short of water are the Hall, Mr. Ward's Farm, and to a less extent the Cottage Home.

Kelmarsh. *Population* (1931), 127. *No. of houses*, 40.

This village obtains its water from a private supply belonging to and maintained by the Kelmarsh Estate. The water is obtained from a well on Haselbech Hill where there is a service reservoir. At the top end of the village are two stand-pipes each serving five houses on the Harrington Road, and two houses have a piped supply. At the lower end of the village there is one stand-pipe serving thirteen houses.

During the summer of 1934, water was turned on for two two-hour periods each day. The water is of good quality.

There are one or two wells in the village, but these are not used for domestic purposes.

Marston Trussell. *Population* (1931), 144. *No. of houses*, 39.

There is one central public well situated at a spot between the gardens of the four Council houses and the main road, from which the greater part of the village obtains its water.

There are some private wells which supply about ten houses. The Hall and one other residence obtain a piped supply from Market Harborough.

Although there appears to have been no actual shortage of water, both the public and the private wells are liable to pollution and it would be a great step forward if a proper piped supply could be obtained from Market Harborough or elsewhere.

Oxendon, Great. *Population* (1931), 253. *No. of houses*, 68.

There is one public pump at the lower end of the village which has a fair supply, but the quality is doubtful. The Council have four groups of houses in the parish with five wells and pumps ; two of these appear to have been very short of water during the drought. There are about twenty-five wells on private properties. The village, as a whole, has always been short of water, although the lower Council well at the Cross Roads and some small supplies in that neighbourhood have been sufficient. Until recently Oxendon Hall depended on a well 85 feet deep which gave a constant supply of 30 to 40 gallons per hour ; the water showed over 47° of hardness.

In order to improve the water supply Major Bates commenced boring operations in 1932, but on reaching the lower lias found the water bearing strata very treacherous and inclined to block the tube. It was necessary to tube past the water that was obtained in this horizon, and boring was continued to 820 feet when a large supply of salt water was struck in the keuper beds. The boring was, therefore, abandoned in August, 1933. Subsequently a well was sunk on the site of the bore reaching to marlstone at 16 feet ; an excellent supply was obtained at this depth and the well was continued to 20 feet. A second well was sunk alongside which produced still more water, and this was joined to the first by a 3-inch tube at the bottom. The water is abundant and rises very quickly to within 5 feet of the surface, and thereafter slowly to ground level. The wells are lined with brick puddled on the outside, and cemented to 6 feet with a cement covering on the top. The supply is estimated to be at least 200 gallons per hour, and the analyses were satisfactory. The wells are situated in an area of about 1,000 acres of grass land and 500 yards from the main road. The water is pumped up to a 10,000 gallon tower at the highest point of the village, from which all the inhabitants could easily be served by standpipes. The requirements of the Hall, and the properties under its control are from 1,000 to 1,500 gallons per day, so that there is a surplus of at least 4,000 gallons, which is ample for the whole village where the water is laid on or served by stand-pipes. The hardness of this supply is only 24 grains per gallon.

Sibbertoft. *Population* (1931), 197. *No. of houses*, 67.

This village has no public supplies, but the public have access to one well situated in a side street. There are about 21 wells on private properties. These supplies are all superificial, obtained from a bed of drift gravel, and are therefore liable to surface pollution. During the summer of 1934 many of these wells became dry, including a well in Front Street serving four Council houses and a well in Middle Street on which several houses are dependent. It should not be impossible to find a source of water free from pollution outside, near to the village, which would provide a wholesome and ample supply at a reasonable cost.

Stoke Albany. *Population* (1931), 296. *No. of houses*, 80.

The public supply is obtained from a spring at the south end of the village, the water from which is led to a small reservoir, and thence by gravity to four stand-pipes This supply has been very short during the drought, and it has been necessary to restrict the service to the time between 8 a.m. and 5 p.m.

Two groups of Council houses have wells, both of which became very short of water during 1934.

There are about twenty-nine wells on private properties. The village is in urgent need of a public piped supply.

Sutton Bassett. *Population* (1931), 70. *No. of houses*, 23.

There is one public well in front of the Wesleyan Chapel. The road drain runs nearby. The well became very short during the summer of 1934.

Four Council houses are dependent on this public well. There are ten private wells of the shallow type which are all liable to pollution.

Thorpe Lubenham. *Population* (1931), 33. *No. of houses*, 5.

These cottages are on the Thorpe Lubenham Estate. Water is obtained from Market Harborough, but recently two wells have been sunk and provision made for the storage of about 6,000 gallons of water for the use of the Estate.

Welford. *Population* (1931), 761. *No. of houses*, 230.

There are two public springs with a good supply even in dry weather, and a spring at the lower end of the village which has an average flow of about 3,000 gallons per day. The Council own twenty-one houses with three wells, all of which have a sufficient yield. There are about sixty-four private wells.

Although no shortage of water has been reported, it is evident that this village would benefit greatly by a public piped supply.

Weston-by-Welland. *Population* (1931), 146. *No. of houses*, 40.

The only supply for public use is a spring in the Rectory Grounds which enters a trough and is afterwards piped to the village pond. This supply became very short during the summer of 1934.

There are four Council houses with one well situated at the top of the gardens. Although this has not failed, it is liable to pollution and is not used by one of the households. There are about seventeen wells on private property.

Wilbarston. *Population* (1931), 480. *No. of houses*, 132.

This village has four public wells distributed through the village. Three of these have a reasonably good supply. The Council's twenty-eight houses have three wells which have not failed during the drought, and there are approximately forty-three wells on private properties.

POTTERSPURY RURAL DISTRICT.

Alderton. *Population* (1931), 74. *No. of houses*, 26.

This village is supplied by two public wells, thirty feet deep fitted with windlass, and a public spring which runs into a dip-well, four feet deep. All draw their water from the limestone. Nineteen households are served.

There are also ten private wells, all shallow and drawing their water from the limestone. The water is raised by pumps, some cast iron, others lead.

None of the wells, public or private, has failed.

Ashton. *Population* (1931), 266. *No. of houses*, 77.

The condition of this village during the drought of 1933 is well set out in the report of the Women's Instititute :—

" Since the end of July this village has been entirely dry, the usual supply failing altogether. Water has been carted daily and obtained in buckets from the water-cart when brought through the streets. Unfortunately there is no other supply of water of any kind and the water obtained from the cart has had to be used for all domestic purposes in addition to drinking. The water is brought from a supply 1½ miles away. It is anything but appetising—it is quite impossible to drink any until it has been boiled.

' Wash-day ' is simply a night-mare, especially in houses where there are several children, while a bath is fast becoming an unknown luxury."

In addition to eleven private wells, there are two separate springs piped to the village, into dummy wells. The springs have failed several times during the last thirty years and thereby caused much inconvenience. Since July, 1933, the Rural District Council have carted water to the village from a spring situated half-a-mile from the south-west side of the village.

In the month of January, 1930, the Potterspury Rural District Council approached Mr. Adams, Ashton Lodge Farm, and obtained permission to develop a spring on his land, situated half-a-mile removed from the north side of the village. After development the yield was consistent at 5,700 gallons per day, during the months of March, April and May. From this date it began to decrease, *viz* : June 3,456 gallons, July 3,275 gallons, August 2,700 gallons.

In the month of September, the Inspector reported as follows, " The yield has fallen to 2,160 gallons per day, which may be taken as the minimum. It will probably increase again during the winter months to about 5,000 gallons."

The Surveyor reports as follows :—

" In 1933, the District Council resolved to connect the village of Ashton with the Hartwell supply, and applied to the Minister of Health for sanction to borrow £2,125 for this purpose.

The source at Hartwell, even in the dry period, proved to be more than sufficient for the two villages. The scheme includes the provision of a new engine house at Hartwell with a two-stage centrifugal pump coupled to a 6 h.p. motor. The old 2-inch cast iron main, which was corroded, is replaced by a 3-inch asbestos cement pumping main, 1,680 yards in length.

The existing service reservoir (T.W.L. 409 O.D.) has a capacity of 15,000 gallons, and is used without alteration to supply both villages.

A new 3-inch asbestos cement main is laid to the east end of Ashton (1,666 yards), and the water distributed through a 3-inch cast iron main 890 yards long, and a 2-inch branch cast iron main (380 yards) along the Stoke Bruerne road. The scheme provides for seven public stand-pipes of the anti-freezing type, and three fire hydrants.

Cosgrove. *Population* (1931), 534. *No. of houses*, 151.

There is one public dip-well, in the form of a spring, three feet deep. The colour of the water suggests that it comes from the iron-stone. This supply is unaffected by weather conditions or the seasons, the flow being constant at about ninety gallons per hour.

There are also fifteen shallow private wells, ranging from 6 feet to 25 feet deep. Seven have pumps, four windlasses, and four are dip-wells. Two failed during 1933.

In addition, there is a private well, 100 feet deep, situated in the " Brewery " Yard, and containing 70 feet of water. Test pumping has proved the supply to be almost inexhaustible. Plans and specifications were prepared to utilize the water from this well as a public supply for the village, but the supply was not sanctioned by the Ministry of Health, on account of liability to pollution.

Old Stratford.

Up to the year 1927, Old Stratford was dependent for its water on shallow wells in the boulder clay. The Council's surveyor gives the following details of the present supply :—

The present undertaking, which is owned by the Rural District Council, was installed in 1927, at an initial cost of £2,065, and serves the whole hamlet, which comprises portions of the parishes of Cosgrove, Furtho and Passenham.

SOURCE.

A borehole, 120 feet in depth, connects with an Artesian well, probably in the marlstone. It is situated 100 yards from the river, and 30 yards north of the Watling Street.

The water, which rises through a 4-inch steel tube, overflows at a height of 9 feet above ground level. The work in connection with this borehole was carried out by private enterprise 45 years ago, and in 1926, by Deed of Assignment, the perpetual Right to take water from the well was granted to the Rural District Council upon payment of an annual rent charge of £8.

STORAGE, AND TRANSMISSION.

The borehole tube is connected to a dummy well regulated by means of a ball valve. The dummy well has a capacity of 1,000 gallons. From here it is pumped by means of a windmill to a concrete reservoir, 20 feet above ground level, of 9,000 gallons capacity, whence the water gravitates to all parts of the area. The windmill pump has a maximum capacity of 450 gallons per hour, and an auxiliary petrol engine has a maximum of 550 gallons per hour.

The water is not filtered or chlorinated.

DISTRIBUTION.

The supply is constant to all parts by both service and stand-pipes.

No. of houses	86
No. of standpipes	4
No. of houses with service pipes...	57

The average daily consumption is 2,000 gallons per 24 hours, while the maximum output of the borehole is 8,000 gallons per 24 hours.

The water is highly mineralized but free from organic pollution. The quality is quite satisfactory for domestic purposes.

Maintenance.

Outstanding capital loans at 30.9.33	£1,399.
Cost of working and maintenance	£2 10 0 per week.
Actual water rate on consumers only :—	
Parish of Cosgrove	1s. 6d.
,, ,, Furtho	7s. 4d.
,, ,, Passenham	2s. 10d.
Present return from water rate	£93 per annum.
Estimated deficit	£40 ,, ,, which is raised in the Special Expenses Rates of the respective Parishes.

Grafton Regis. *Population* (1931), 100. *No. of houses*, 27.

This village has two public wells. No. 1, 70 feet deep is fitted with a windlass, and No. 2, 6 feet deep, is a dip-well. Fourteen households are supplied by these two wells.

There are also ten shallow private wells, drawing their water from the limestone. Five are fitted with cast iron pumps, and five are dip-wells. Of the latter, four failed in October, 1933, making it necessary for nine households to carry water 200 yards from one of the public wells.

Hartwell. *Population* (1931), 337. *No. of houses*, 106.

A scheme for water supply was brought forward in 1903, but no application was made to the Local Government Board till 1906. The scheme, which was estimated to cost £1,200, was inaugurated in 1907.

The main features of the present supply are as follows :— The present undertaking is owned by the Rural District Council and serves the whole village, together with two or three large premises in the vicinity.

Source.

The well is sunk to a depth of 33 feet, through 24 feet of alternate layers of rubble and clay, and 9 feet of limestone. It is 6 feet in diameter and lined from the surface to a depth of 6 feet in 9-inch brickwork set in cement mortar, followed on by 4½-inch dry brickwork. The rest level of the water in the well is normally 13 feet.

Storage and Transmission.

The well is situated three-quarters of a mile from the village in the centre of one acre of land which is uncultivated and fenced round. The water is raised and delivered through a 2-inch cast iron pipe into a reservoir near the village, at an elevation sufficient to gravitate to all parts of the village.

The reservoir consists of brickwork and concrete, being partly under and partly above ground level, and has a capacity of 16,000 gallons.

The pumping unit is a windmill, with maximum capacity of 420 gallons per hour, and an auxiliary petrol engine, capacity 700 gallons per hour.

The water is not filtered or chlorinated.

Distribution.

The supply is constant to all parts of the village ; nineteen houses having the water laid on, and the remainder of the village (95 houses) is served by twelve stand-pipes.

The water is hard, but of excellent quality. The average daily supply for domestic purposes is 2,000 gallons.

MAINTENANCE.

There are no outstanding capital loans.

Present cost of working and maintenance	£2 5 0 per week.
Water Rate	None, but £12 per annum from Water Rents under Agreement.
Estimated deficit	£80 per annum, met by a Special Expenses Rate.

Although the level of water has fallen from 13 feet (normal) to 9 feet, it has remained there consistently for some time, and the present supply would appear more than sufficient.

Passenham (*including hamlet of Deanshanger*).

Deanshanger. *Population* (1931), 914. *No. of houses*, 247.

The public water supply of this parish is owned by the Rural District Council. It was installed 40 years ago at an initial cost of £900.

The supply became inadequate in September 1921, and until December 1925 it was necessary to augment the supply by carting water from " Pigeon Ford " spring, a quarter of a mile north-west of the village.

Meantime the Council carried a heading into the rising ground at the rear of the village on the north and intercepted a spring yielding 300 gallons per hour. By means of a 2-inch galvanised pipe it was conveyed to, and connected up with, the village main. This added supply was sufficient to meet all requirements until the first week in December, 1933, when the water in the tank fell to 1 foot (normal level 6 feet) thereby causing two stand-pipes near the Church to fail. These stand-pipes only function when the level of water in the tank is more than 1 foot 6 inches.

The Surveyor gives the following particulars of the present public supply :—

SOURCE, AND STORAGE.

An excavation, 24 feet by 15 feet by 14 feet deep was made in order to intercept, collect and retain the contents of a spring 200 yards north of the village. The bottom of this excavation is provided with 12 inches of concrete, and the sides are lined with 18 inches of brickwork, cement rendered, to ground level; the top of the tank is covered over by means of brick arches on steel girders, and is fitted with a manhole.

The water comes from the limestone, and normally stands at 6 feet in the tank ; the daily yield being 3,000 gallons.

The storage capacity of the tank is 14,000 gallons, and it is sufficiently elevated to supply all parts by gravity, except the two stand-pipes referred to above.

The water is not filtered.

DISTRIBUTION.

There is a constant supply, by gravitation, to all properties. Twenty-two houses have the water laid on, and 148 houses are served by fifteen stand-pipes.

The supply has been sufficient for all except the users of the two stand-pipes referred to above, who have had to fetch water from other stand-pipes 100 yards distant.

MAINTENANCE.

Outstanding capital loans—nil.
Cost of working and maintenance—10/- per week.
Water Rate and Rents—nil.
Estimated deficit on the undertaking—£20, which is raised by Special Expenses Rate of the Parish of Passenham.

Twenty-four houses in Puxley Road and thirteen in the Whittlebury Road are not supplied by the public undertaking, but depend on two private wells ; they are above the gravitation limit of the public supply.

The two wells are 30 feet deep into the limestone. The water is raised by cast iron pumps, with galvanised suction pipes. Both these wells partially failed in November, 1933, when they were deepened from 27 to 30 feet, with satisfactory results.

Paulerspury. *Population* (1931), 797. *No. of houses*, 231.

There are three public wells in this village. One, situated in Pury End, consists of a pit three feet deep fed by a spring issuing from the limestone. It is a dip-well, serving fifteen houses, and there is always an overflow. The second is a deep well, (70 feet) which serves twenty-five households ; the water being raised by means of a pump. This well had not been known to fail until December 1933. At that time three feet of mud were removed from the bottom, and the suction pipe lengthened. The supply has been sufficient since. The third well is situated at the Plumpton end of the village. It is 9 feet deep and serves eleven houses by means of a cast iron pump. The supply has always been sufficient.

An outstanding feature ot the water supply of this village is the large number of private wells—seventy-five—ranging from 6 to 27 feet in depth. About half are fitted with pumps, ten with windlasses, and the rest are operated by means of a bucket on a pole, usually about 9 feet in length.

Five private wells failed during the present drought, and many others are much lower than usual. Three shallow wells near the site of a borehole sunk in 1932 were unaffected by the drought.

In connection with a proposed housing estate, a bore-hole was sunk in 1932 to a depth of 234 feet. The middle lias was tapped, and a fairly abundant supply of liquid was discovered—15,000 gallons per day. This proved to be quite unsuitable for domestic use, the total mineral constituents amounting to 236 parts per 100,000, with a chlorine content of 80 parts per 100,000. The water tasted of ‘ warm flat-irons.’

This boring was therefore abandoned, and the new houses were supplied by means of underground tanks to collect rainwater. This supply has not been very satisfactory.

Potterspury. *Population* (1931), 731. *No. of houses*, 201.

An early report of the County Medical Officer of Health, dated 1898, refers to a serious outbreak of Enteric Fever due to polluted wells. A scheme of water supply was introduced, but owing to opposition of the parish, was not proceeded with by the District Council. Epidemics, like wars, are easily forgotten. Dr. Paget described the water supply as " abundant but polluted." " Were water-borne disease more rife within the villages," he continues, " the inhabitants would be more readily aroused to the dangers attending the use of water liable to contamination ; but in its absence, or while it is merely periodic, they are content to take their chance of illness and avoid the construction of works of public safety."

In 1913, a scheme for Potterspury was brought forward at an estimated cost ot £3,500, and the present undertaking was opened in 1914. The scheme, which was provided by the Rural District Council, consists of a well, 50 feet deep, which draws its water from the limestone. Here the limestone is covered by 12 feet of clay.

The well is 6 feet in diameter, and is lined from the surface to a depth of 8 feet with 9-inch brickwork, set in cement mortar, and below with 4½-inch dry brickwork.

The water normally stands at 8 feet, but from August, 1933, it began to drop gradually, and by January, 1934 it had fallen to 2 feet. From this time the water has been turned off from 8 p.m. to 8 a.m. daily.

The average daily supply for domestic purposes is 4,200 gallons.

STORAGE AND TRANSMISSION.

The well is situated a quarter of a mile from the village, in the centre of one acre of land, uncultivated and fenced round. On the site of the well is a cast iron water-tower, 25 feet above ground level, at an elevation sufficient to cause the water to gravitate to all parts of the village. The capacity of this tower is 25,000 gallons. The water is raised from the well to the tower by a windmill, maximum capacity 500 gallons per hour, and an auxiliary petrol engine, maximum capacity 700 gallons per hour.

The water is not filtered or chlorinated.

DISTRIBUTION.

The supply is constant to all parts of the village. Forty-six houses have the service laid on, and the remainder of the houses, approximately 154, are served by twenty-four stand-pipes. There are also six fire hydrants.

MAINTENANCE.

The outstanding capital loan on 30.9.33 was £1,096, and the present cost of working and maintenance is £2 per week. Both of these charges are met by the Special Expenses rate of the parish.

Wicken. *Population* (1931), 301. *No. of houses*, 95.

This village is primarily supplied with water pumped by means of a wind-engine from a well sunk in 1896 at the expense of the second Lord Penrhyn in a field known as " Twenty Lands " situate on the Manor Farm to the north-west of the village at an elevation of 328 O.D. The well is cylindrical, 6 feet 9 inches in diameter, cut through the limestone to a depth of 51 feet, and the upper part is lined with 9-inch brickwork built in cement, clay-puddled behind. The pump lifts the water into two service reservoirs built of brick, backed with concrete, and cement rendered inside. Each is capable of holding 10,000 gallons. The water gravitates from these through 2½ inch cast iron mains, to supply twelve stand-pipes in the village, and six fire hydrants. The well showed signs of running low in December, 1933, but its yield increased again in January, 1934.

An auxiliary supply is derived from a natural spring situate in the " Washwell " at a point three-quarters of a mile to the south-east of the village, and is reputed never to have failed. The water there flows into a brick tank of 700 gallons capacity, whence it is forced into the village mains by means of a wind-engine, with an auxiliary oil engine. This source also supplies " Sparrow Lodge " and " Dagnall " Farms at each of which there is a reservoir of 5,000 gallons capacity. Normally this spring yields 4,500 gallons per 24 hours, but the yield temporarily diminished in January, 1934, to 2,160 gallons. Strangely enough this spring withstood the present drought better than the one in 1921, when the yield was down to 1,440 gallons per day in October of that year, and it gradually shrank until December, 1921, when it showed signs of recovery. In addition to the village supplies, these two sources are normally sufficient for baths, W.C's., cattle troughs and fire hydrants at three or four farms on the Estate.

There are in addition a number of shallow wells in the village which can be used for washing or watering in times of emergency, but it was not necessary to use them in 1933.

Wicken Park Mansion has a private supply, derived from two wells. The water from one is pumped to the tanks on the roof of the house by means of an oil engine. The second well, 71 feet deep, which normally contains 13 feet of water feeds two reservoirs, whence the water gravitates to a farm and two cottages and cattle troughs, and can also be used to augment the supply to the Park Mansion. This well showed signs of shrinkage in August, 1933, but the yield was always sufficient to keep the reservoirs full. Two other farms are supplied by private wells, 30 and 32 feet deep respectively.

Yardley Gobion. *Population* (1931), 475. *No. of houses*, 134.

Until 1933, Yardley Gobion was dependent for its water supply on three public wells and approximately fifty private wells.

An outbreak of Epidemic Jaundice in 1926 directed attention to the pollution of these wells, and a proposal was brought forward to give the whole village a piped supply at an estimated cost of £2,600.

The present undertaking is owned by the Rural District Council and supplies the whole village, with the exception of an isolated group of houses known as Moor End.

Particulars of the present supply are as follows :—

SOURCE.

The supply is obtained from a developed spring, situated a quarter of a mile from the north-west end of the village. The spring water is conveyed to a concrete covered, four square, tank of 8,000 gallons capacity.

STORAGE.

A suitable fence is erected around the spring one hundred feet square. The water is raised and delivered through a 2-inch cast iron pipe, into a concrete reservoir near the west end of the village. This reservoir is 25 feet above ground level, at an elevation sufficient to gravitate to all parts of the village, and has a capacity of 32,000 gallons.

The power for pumping consists of a windmill maximum capacity 450 gallons per hour, with an auxiliary 5 h.p. crude oil engine, capacity 7,500 gallons per hour.

No filtration or chlorination is necessary.

DISTRIBUTION.

The supply is constant to all parts of the village, either by service or stand-pipe. No. of houses approximately 140. There are nine stand-pipes and thirty-two houses have service pipes.

The result of gauging this spring periodically during the year 1931-32 showed a variation of about 80,000 down to 8,000 gallons per 24 hours. The yield on 29th January, 1934, was the lowest on record, *viz.*, 5,400 gallons per day.

It is estimated that about 5,000 gallons per day will be required for all purposes.

QUALITY.

Samples were found to be of good quality chemically, but showed 38° of total hardness (23° temporary). Bacteriological findings were satisfactory.

MAINTENANCE.

The outstanding capital loans on 30.9.33 were £2,555. Figures as to cost of working and maintenance, return from water rates, etc. are not yet available.

THRAPSTON RURAL DISTRICT.

Aldwincle. *Population* (1931), 316. *No. of houses*, 98.

There is one public well, controlled by the Rural District Council. It is spring-fed and has its origin in the great oolite limestone. About 10 per cent. of the population are served in this way, and the remainder are dependent on private shallow wells.

The water supply is admittedly unsatisfactory, and not free from risk of gross pollution. The most satisfactory remedy is to link this village with a regional scheme, or alternatively to seek a new source in the river gravel and treat the water by chlorination.

Brigstock. *Population* (1931), 925. *No. of houses*, 243.

The history of Brigstock water begins in 1899 with an outbreak of Enteric Fever. The District Council, on behalf of the Parochial Committee, purchased in 1900 an acre of land for waterworks at a cost of £107 10s. 0d. A trial well was sunk and a satisfactory supply found. In November, 1902, the Local Government Board held an enquiry, on an application for a loan of £2,600. At that time apparently nearly all the wells in the village (20 feet in limestone) were polluted, and the condition of Harper's Brook was unsatisfactory.

The scheme consisted of a well 40 feet deep drawing a supply of over 150,000 gallons per day from Lincolnshire limestone. The water was to be raised by a windmill to a reservoir of 50,000 gallons capacity, and distributed by gravity to the parish by 4-inch and 3-inch mains. A good deal of delay occurred in the execution of the scheme, and the water was finally turned on in the year 1905. The pressure was evidently good, as the landlord of the " Green Dragon " discovered, when the first jet smashed his windows.

The general particulars of the present supply are :—

SOURCE.

(1) *Well*, 45 feet deep, in Lincolnshire limestone, 8 feet in diameter, brick lining.
Rest and pumping levels 3 feet 6 inches and 1 foot 9 inches.
Stands at 1 foot 9 inches after 10 hours pumping.

(2) *Transmission* from well to service reservoir in cast iron main by pumping. One 3½ h.p. oil engine and one 6 h.p. semi-diesel.

(3) *Service.* Reservoir (50,000 gallons) of brick and concrete. No filtration or other treatment.

(4) *Distribution* by gravitation to the whole village, and to a training centre of 250 inhabitants. Approximately 200 properties are supplied, by internal pipes. There are twelve fire hydrants, but no stand-pipes. The average daily supply is 16,000 gallons, and there has been no deficiency during the present emergency. Both chemical and bacteriological examinations are satisfactory.

Chelveston. *Population* (1931), 354. *No. of houses*, 95.

The four public wells are controlled by the District Council. They are spring-fed, drawing an indifferent supply from cornbrash. Three shallow wells are of the " dipping " type, and the fourth, rather deeper, has a suction pump. These supplies, which serve 80 per cent. of the people, have fallen off seriously during the Summer. The private wells are all shallow and liable to pollution.

Clopton. *Population* (1931), 114. *No. of houses*, 31.

This village rests on the Oxford Clay and has no water. The one public well drains surface water, when any is available, and has to serve for 80 per cent. of the population. The remainder of the wells supply occasional quantities of polluted surface water.

This village is relatively remote and difficult to serve, but there is reason to hope that the Eastern regional scheme of the Oundle Rural District Council will solve this annual problem.

Denford. *Population* (1931), 347. *No. of houses*, 100.

The two public wells (about 6 feet deep) are fed by springs from the cornbrash and great oolite. These dip-wells are failing steadily, and a public piped supply is urgently required. About 40 per cent. of the population depends on private wells. Recent analyses show serious organic pollution.

Denford is included in the Woodford Regional Scheme.

Great Addington. *Population* (1931), 292. *No. of houses*, 71.

Great Addington appears to have ample supplies of water, but the springs have not been utilised to any extent. The District Council are responsible for a service from a spring which feeds a small reservoir. The water is conveyed thence by a galvanised pipe to four standards in the village. The spring no doubt issues from ironstone. There are also two spring-fed public wells which serve about 30 per cent. of the village. The remainder go to the standpipes. The wells are shallow, derived from the cornbrash ; and they have shown signs of failure during the dry period. There are also private (cornbrash) wells, with poor supplies at present. The water is very hard.

The District Council feel, rightly I think, that it is better to include this village in a regional scheme, than to set up a separate pumping apparatus to exploit the existing springs.

Hargrave. *Population* (1931), 239. *No. of houses*, 64.

Hargrave, which lies far out on the Huntingdonshire border, has a long, pathetic history of water famine. The village rests on a mass of impervious Oxford clay and is dependent on such surface water as it can catch in ponds. It has been necessary to cart water from Raunds since October 1933. The obvious, and only satisfactory remedy for Hargrave's difficulties is that which Dr. Elliott put forward in 1915—a piped supply from Raunds Urban District. This consummation is at last within reach, and an agreement with Raunds is all but settled.

Islip. *Population* (1931), 675. *No. of houses*, 188.

In 1922 a suggestion was brought forward that Islip and Thrapston should combine in a water scheme, but ultimately an independent private supply was installed at Islip. The source of the supply, which is owned by the Drayton Estate, is a noted spring in the gravel near the River Nene.

The water from the spring is held back in a basin by a concrete dam, and conveyed by a 6-inch iron pipe to a large brick filter-bed divided into three compartments. From this it is pumped (*a*) by windpower, (*b*) by a reserve 4 h.p. engine against a head of 110 feet to a concrete reservoir of 50,000 gallons capacity. The total cost of the scheme was approximately £2,100. The average yield of the spring is stated to be 70,000 gallons a day. A second pumping engine of 4½ h.p. has since been installed.

The present supply is laid on to 112 houses and there are four stand-pipes in general use. About thirty-six premises still utilise private wells. The Women's Institute reports that the supply is excellent in quality and quantity, and recent analyses confirm this statement.

Little Addington. *Population* (1931), 280. *No. of houses*, 69.

Little Addington, has two public wells controlled by the District Council. These wells, which are spring-fed from the cornbrash, have to serve about 80 per cent. of the people. There are also a number of private wells. The supply has diminished very much during 1933, and some wells have entirely dried up. The Women's Institute report shows a plan of four main wells, and indicates that many housewives have to go considerable distances for their drinking water. This village is included in the Council's regional scheme from Woodford.

Lowick. *Population* (1931), 302. *No. of houses*, 86.

The village of Lowick is supplied from the *Drayton Estate*, by means of a brick underground reservoir. Eighty-six properties are served by internal pipes, and sixty-four by stand-pipes. Twenty-two properties are still dependent on wells.

Ringstead. *Population* (1931), 916. *No. of houses*, 247.

Ringstead village has an unhappy history, as acute shortage of water was reported as early as 1905.

There are at present four shallow public wells (about 10 feet from the great oolite) on which 80 per cent. of the population precariously depend. The private wells are similar. All are uncertain in quantity and polluted. Recent analyses of representative samples indicate that the water is unsafe.

An interesting study of the situation by the Women's Institute shows that many housewives have to go more than 50 yards for water, and some as far as 600 yards. One of the wells is moderately soft, but the remainder are very hard, and useless for washing. It is evident that there has been a grave shortage in 1933, and one notes with satisfaction that this village is included in the Woodford Regional Scheme.

Slipton. *Population* (1931), 80. *No. of houses*, 24.

The village of Slipton is supplied by the Drayton Estate. The source is a spring, probably from limestone, and the water flows to a storage well, whence it is raised by a windmill pump to a concrete reservoir of 10,000 gallons. Approximately sixty premises are served by this supply (stand-pipes), and there is also a public well in Twywell parish. An analysis made in 1933 was satisfactory.

Stanwick. *Population* (1931), 928. *No. of houses*, 239.

The large village of Stanwick is in desperate straits for water. There are three shallow public wells, fed by springs from great oolite and cornbrash. There is also one pump which draws surface water only. Nearly half the village depends on shallow private wells many of which fail during the Summer. Recent analyses are unanimous in declaring the water supplies unsafe for drinking.

In 1912 the Parish Council reported that there were eighty-nine wells in the village, eighty-three of which were fit for domestic use. They therefore submitted " that the present supply of water was sufficient to meet the needs of the parish."

In 1915 the Parish Council recognised the desirability of a water supply—a step forward, to be sure—but felt that the time was inopportune. The question was ultimately adjourned until the end of the war, with the approval of the District Council.

The long adjournment is now drawing to its close, and arrangements are being made for a piped service from the Urban District of Raunds.

Sudborough. *Population* (1931), 180. *No. of houses*, 53.

In 1920 the District Council purchased for £650 a private water supply owned by Lord Barnard. The works originally cost about £1,200.

The present supply is derived from springs which are led to a 16,000 gallons reservoir of brickwork and cement. Twelve houses are fed by internal pipes, and there are seven stand-pipes. The Women's Institute report that the supply is constant and satisfactory.

Thrapston. *Population* (1931), 1,679. *No. of houses*, 458.

The history begins in 1905 with a request by the Local Government Board for information on the subject of water supply. The Parochial Committee make the customary reply that " it is not necessary at present, . . . water for all purposes but drinking is abundant throughout the parish, and water for drinking purposes is obtainable at reasonable distance in almost every case."

The Local Government Board are frankly dissatisfied with the reply. The Medical Officer of Health reports that there are 165 wells, and that many of the sources of supply are contaminated with sewage. The Parochial Committee decided to " clean its wells " and there the matter stood for three years.

In 1908 a committee was appointed to investigate the water problem. This body reported in 1909 " that the quality of the water may have improved owing to sanitary improvements."

This report did not satisfy either the District Council or its Medical Officer of Health :—

" *Col. Sackville* :— ' I should always protest against the inaction of the Thrapston Parish Council. I think it is most dangerous to the health of the town to be left in this sort of way—water-closets flushed by hand, and no proper water supply.'

Capt. Wallace :—" I propose 'that this Council is not satisfied that the water supply of Thrapston is sufficient either for drinking purposes or for sanitation.' "

This resolution was carried.

I need not follow the devious windings of controversy which cover thirty pages of my records. It was not until 1914 that the pressure of the District Council moved the Parish to take the first step towards a water supply. Dr. Elliott's report of that year shows that he was at last rewarded for twenty years' patient effort to give Thrapston a wholesome supply of water. Unfortunately the war intervened and the original scheme, estimated to cost £6,100, dragged on until 1926, when application was made for a loan of £8,600. The scheme was finally completed in 1929. The details are as follows :—

SOURCE :

A well 15 feet 6 inches deep in the valley gravels. The water (up to 30,000 gallons a day) is pumped in 4-inch cast iron pipes by a 10 h.p. electric motor to a service reservoir.

SERVICE :

A reinforced concrete reservoir of 50,000 gallons capacity on the Huntingdon Road : top water level 235 O.D. and 195 O.D. the highest point served. No filtration or other treatment.

DISTRIBUTION.

Distribution is by gravitation from the service reservoir. 80 per cent. of the population have the pipes laid on, and 20 per cent. are still dependent on private wells. There are fifty-three hydrants, but no stand-pipes, in the town.

The average quantity supplied in 24 hours is 13,500 gallons, in January 1934 a daily yield of 30,000 gallons was available.

Titchmarsh. *Population* (1931), 557. *No. of houses*, 167.

Titchmarsh has five public wells, controlled by the District Council. One of these is 47 feet deep, but the remainder are about 10 feet, drawing their supplies from the great oolite 70 per cent. of the population are dependent on the three suction pumps, and two dipping wells The private wells have a similar source.

The Women's Institute reports that, on an average, eight families use each " parish " well. Housewives in many cases have to go from 20 to 200 yards four or five times a day for water.

Four parish wells failed for about three weeks, and a number of private wells were dry during the whole Summer.

The wells are mostly very shallow, some draining only surface water. Four wells have been condemned from time to time, but are still in use.

It is evident that a piped supply for Titchmarsh would be of great benefit.

Twywell. *Population* (1931), 443. *No. of houses*, 117.

Complaints of an inadequate water supply are recorded as far back as 1908, and that year it was decided to pipe water from a spring to a 3,000 gallons reservoir in the village.

There are at present two public wells fed from springs issuing from the great oolite. These serve approximately 70 per cent. of the village. During 1933 there has been a serious shortage of both public and private supplies.

The Rural District Council have installed a piped supply from the Woodford well, as a forerunner of their regional scheme.

Woodford. *Population* (1931), 1,342. *No. of houses*, 337.

A scheme of water supply was first brought before the Parish Council in 1900, but apparently it miscarried, partly on the ground of expense, and partly because it failed to satisfy the Local Government Board. It was reported at this time that a state of water famine existed every summer in Woodford. £103 was spent on the original scheme.

In 1901 the parish adopted a scheme for making a reservoir of 100,000 gallons capacity, but evidently the quality of the supply was not above suspicion. The new works were opened in 1902. They consisted of a well 20 feet deep, from which water was pumped by a wind-engine to the 100,000 gallon covered concrete reservoir. The cost—a little over £500—was paid out of current rate. A further £74 was spent on stand-pipes, etc., in 1904. In the same year, however, the supply from the waterworks gave out, and a water-cart had to be brought into use. In 1910 the supply was again unsatisfactory, apparently owing to waste, and lack of wind-power. A scheme for improvement, at a cost of £400, was brought forward, but apparently held in abeyance during the war. The water supply was again an important subject of discussion in 1925, when the parish adopted a partial scheme at a cost of £820—for the creation of a pump house, and laying mains to the existing reservoir. The new source (Pyle's Spring) gave a supply of 17,000 gallons a day. Unfortunately the reservoir water was found to be polluted. A Ministry of Health Inquiry was held in 1926. The final scheme, brought forward in 1931, was estimated to cost £5,000. It was shortly discovered that the yield of the well was much greater than had been anticipated, and the Thrapston Rural District Council wisely decided to press forward with a regional scheme, to include a number of villages in which the shortage was acute. The following is an outline of the present scheme so far as it affects Woodford.

Cost of undertaking, £6,000.

SOURCE.

A well 16 feet deep, and 15 feet diameter, with a concrete lining, situated in the valley gravel at 103 feet 10 inches O.D.

TRANSMISSION.

Transmission to the reservoir in 4-inch cast iron pipes by a 12 h.p. electric motor. Service reservoir of reinforced concrete, 286.52 O.D. (highest point served, 233.00 feet), with a capacity of 30,000 gallons.

DISTRIBUTION.

By gravitation. The supply is laid on to practically all the houses—a population of 1,343. There are 28 hydrants, and no stand-pipes.

The average quantity supplied is 8,000 gallons a day, but the possible yield is stated to be 700,000 gallons a day.

The analyses show that the water, although hard, is of good quality.

TOWCESTER RURAL DISTRICT.

Abthorpe. *Population* (1931), 272. *No. of houses*, 83.

The District Council is responsible for the undertaking which serves the whole village. The parish has suffered badly, year after year, from shortage and polluted water supplies. In 1933, when there was a serious shortage, a spring was found in a field adjoining the old supply ; it was tapped and fed by means of a small pump to the existing storage tank.

The present scheme derives water from shallow gravel sources and yields about 1,500 gallons daily. Water is led to a brick reservoir of 800 gallons and thence by gravitation to six stand-pipes. Water is laid on to six houses and the whole village relies on the supply. The ordinary service failed entirely in 1933, and the spring water from an adjoining field was pumped by hand to the reservoir ; there are no capital charges. The present cost of maintenance is about £26, and the whole of the expenditure is rate-borne.

Adstone. *Population* (1931), 112. *No. of houses*, 33.

Adstone has one public pump which serves eleven properties (41 persons). There are eleven private wells serving forty persons. The supplies have been short during the drought, but none of the wells has actually failed. There appears to be sufficient water for the present needs of the village.

Blakesley. *Population* (1931), 376. *No. of houses*, 111.

The records relating to water supply date back to the year 1901, when Mr. Eunson advised a trial boring through the upper lias clay. In Blakesley more than a dozen borings have been put down, but only to a maximum of 50 feet. All the wells derive their supplies from the base of the ironstone and penetrate the upper lias clay to a short distance only. In Mr. Eunson's scheme the trial well was found to yield 2,400 gallons per hour, which would give over 100 gallons per head of the population. The scheme was estimated to cost £1,670, plus £150 for the land.

A Local Government Board Inquiry was held in 1902 for sanction to borrow £1,900 on water supply. At the Inquiry, Mr. C. W. Bartholomew made an offer " to give to the village, as a memorial of our late Most Gracious Majesty, The Queen, and to inaugurate the accession of His Majesty King Edward the Seventh, a system of sufficient water for the free use of the inhabitants and their descendants, the cost of which would be defrayed out of my privy purse." This scheme was prepared and carried out by Mr. Bartholomew, and consisted of a reservoir holding a fortnight's supply fed from a well and yielding about 10,000 gallons a day at the time when it was installed. The water supply appears to have been satisfactory, apart from minor modifications, up to the year 1930, when it became necessary to spend some £300 for renewal of the pumps and other improvements. The following are the main features of the present supply. The authority is the Towcester Rural District Council, and area of supply is the village of Blakesley only.

SOURCE.

Water is derived from springs which issue from the Northampton sand underneath a layer of boulder clay and gravel. The collecting well is 38 feet deep, 4 feet in diameter, and lined with brick. Water is pumped by a wind engine and a petrol engine to two storage tanks constructed of brick lined with cement ; these tanks adjoin the well and have a capacity of 25,000 gallons each. There is no filtration or other form of treatment.

DISTRIBUTION.

The reservoir gives a constant supply by gravitation to a population of 277 ; 92 houses are served by internal pipes and 69 by stand-pipes (8). About ten properties are dependent on private wells which are stated to be good and sufficient. The average quantity, all domestic, supplied in 24 hours, is 2,500 gallons.

MAINTENANCE.

There are no loans outstanding ;. the cost of maintenance is approximately £55 per annum, and a water rent is charged according to scale, giving a return at present of £27 per annum ; the deficit of £28 is borne by a special rate on the parish.

Blisworth. *Population* (1931), 792. *No. of houses*, 217.

This village has no piped supply, but there are three public wells : the first of these (Alexander's) serves about 100 people in all and is of moderate quality ; the second (the School well) is considered unfit for domestic use, and the households nearby have to fetch their drinking water from Alexander's pump ; the third, a dip-well known as The Drum, serves about 76 people ; the quality is only fair, and there has been some shortage during the year.

There are 49 private wells serving 416 people in all ; they appear to be all shallow in type, passing through ironstone to reach the upper lias clay. Twenty-nine are supplied with hand pumps, and there are eighteen draw-wells and two dip-wells. Five wells are reported to have failed during 1933, affecting about ten per cent. of the population. In addition, two parts of the village are supplied with water derived from springs—(1) the south-west corner along the Towcester Road supplies ten houses (twenty-nine people) ; (2) railway cottages in the Northampton Road have a very good supply for twelve houses (forty-four people). There are many good springs in the surrounding fields, several of which run into the canal. It is evident, however, that there are really no satisfactory local supplies, and the village should become part of a general scheme of water supply.

Bradden. *Population* (1931), 89. *No. of houses*, 25.

This village has two public wells ; No. 1 supplies nine households (twenty-seven persons) and No. 2 six households (twenty persons) ; both have pumps fixed. During the present season the wells have been low, but have not given out altogether.

There are nine private wells, serving forty-two persons in all, and there are also three springs in the fields to the south of the village which also appear to give a fair supply of water ; there has been no failure of supply during the year.

Cold Higham. *Population* (1931), 242. *No. of houses*, 70.

Cold Higham had an outbreak of typhoid fever in 1883, when all the wells in the village, except two, were condemned, *viz.*, the School House, and the Cottage in the north-west of the village. The Duke of Grafton and the Rector of the village paid for the installation of a supply from a spring near Grimscote. Water was pumped by means of an hydraulic ram to a tank in the village, and thence to the Rectory. The overflow from the Rectory tank is carried to the houses in the north-west of the village, and three houses have internal connections. In 1927 the old ram had become obsolete and the supply was taken over by the District Council ; a new ram was fixed and storage tanks put in ; the cost of this extension was £495. There are two stand-pipes in the village. The water supply has been adequate for the village of Cold Higham, and no shortage was reported in 1933.

SOURCE.

The present supply is derived from a spring in the ironstone, from which a ram raises water to one 50 gallon slate tank at Cold Higham, and two 500 gallon tanks at Grimscote.

The piped supply to Grimscote was installed in 1926, but nearly all the former use water from their own private wells. There is an excellent spring in the north of the village with a covered " top " and a water trough. Before the water supply was introduced, the cottagers fetched their drinking water from this source. The Grimscote tank serves two stand-pipes, but there are no houses with water laid on ; the supply appears to be ample in quantity, and of very good quality.

MAINTENANCE.

The maintenance cost is approximately £40 per annum for the parish, and the water rent brings in £30 per annum ; the deficit is borne by a special rate on the parish.

Easton Neston. *Population* (1931), 132. *No. of houses*, 32.

The supply is from a reservoir in the Old Clay Pit at the Ironstone Pits, Northampton Road. The reservoir is approximately 150 yards long by 100 yards wide, and graduates to a maximum depth of about 50 feet. Engine and windmill pumps raise and pass the water through filter beds and it then flows by gravity. Easton Neston House and Lodge have supplies laid on to sinks, etc.

In Hulcote village the following houses have supplies laid on :—

Manor Farm House,	Hulcote Farm House,
Miss Clare's,	Mrs. Liddle's.

There is one stand-pipe in Hulcote village for seventeen cottages. During 1934 there has been no actual shortage of water, although the reservoir sank approximately 8 feet during the year.

Gayton. *Population* (1931), 362. *No. of houses*, 100.

There is a special interest in Gayton owing to the fact that it was the site selected for a deep boring carried out by the Northampton Waterworks Company. This boring reached a depth of 994 feet and penetrated 105 feet of old red sandstone ; this boring yielded 100,000 gallons of salt water per day from the Trias. In 1901, the Towcester Rural District Council applied to the Local Government Board for sanction to borrow £1,650 to supply water for the parish. The scheme proposed to supply water from a spring which was yielding over 23,000 gallons a day ; the water issued from an outcrop of the oolite limestone overlying the lias clay, and was collected in a well 10 feet deep and 5 feet in diameter ; it was proposed to pump up, by means of a windmill, from the underground reservoir of 40,000 gallons capacity to a higher tank at a height of 97 feet above the level of the spring, in order to supply the upper parts of the village. Ultimately a tender of £1,625 was accepted, but an extra loan was required before the scheme was complete. Apart from trouble from time to time with the windmill, the supply was apparently satisfactory until after the War. New springs were tapped in 1920 owing to a shortage in 1918, and a ram was fixed to give an additional service. At the present time Gayton is served by gravitation from the reservoir of 50,000 gallons ; the number of persons served is 240, and 27 houses have water laid on. There are seven stand-pipes for the remainder of the village and five hydrants. Approximately eleven houses and three farms are dependent on private wells.

MAINTENANCE.

There are no outstanding loans. The cost of maintenance is approximately £70 per annum, and the whole cost of working and maintenance is rate-borne, there being no water charges.

Greens Norton. *Population* (1931), 664. *No. of houses*, 199.

The water supply was first provided for this village in 1902 ; the District Council is now responsible for the undertaking. Water is derived from a spring in meadow land, and runs to a small brick storage reservoir ; from this there is a constant supply by gravitation serving 484 persons. Fifty-nine houses are supplied by internal pipes and thirteen rely on private wells. There are nine stand-pipes and four hydrants. The supply has never been known to fail, and appears to be satisfactory in quality also. The amount borrowed for the construction of the waterworks was £500, and the loan and interest were paid off in 1926. At the present time the scheme is self-supporting. Water rents amount to £46 a year.

The hamlets of Duncote and Littleworth have no public supplies ; in Duncote there is a ram which serves Duncote Hall and practically the whole village ; the houses at Littleworth have two private wells ; no shortage has been reported.

Lichborough. *Population* (1931), 222. *No. of houses*, 70.

This village has a long history. An outbreak of typhoid fever was reported by the Medical Officer of Health in the year 1899, and an investigation of the wells at that time showed that many of them were grossly polluted. The inhabitants communicated with the District Council and asked that a water supply should be provided ; a good deal of time elapsed, and evidently the dangers of typhoid fever were gradually forgotten.

In 1903 it was reported that at a parish meeting only twelve inhabitants supported an application for a water supply ; the parish representative suggested that no action be taken, and no action was taken.

Frequent outbreaks of infectious disease caused the Rural District Council to take further samples of water from Lichborough wells in 1923, and the majority were found to be polluted. A scheme was prepared to supply the village by means of a ram, and a Ministry of Health Inquiry was held for sanction to borrow £1,400.

The present system derives its water from springs in the ironstone which are stated to yield approximately 15,000 gallons a day ; water is collected in three galvanised tanks of 6,000 gallons capacity ; and fed by gravitation to the village ; 155 persons are served, but the water is laid on to one house only ; there are five stand-pipes and two hydrants. Eleven premises are dependent on private wells. The present supply is stated to be 3,200 gallons daily, and no shortage has been reported.

The outstanding loan is £893, and the cost of maintenance is approximately £100 a year. A water rent charged according to scale brings in £40 per annum, and the deficit of £60 is borne by a special rate.

Maidford. *Population* (1931), 190. *No. of houses*, 60.

An outbreak of typhoid fever occurred in 1873, when practically all the wells in the village were condemned. There have been no additions to original supply. The cost of the present scheme, which consists of a small collecting tank and runs by gravitation to the village, was borne by Mr. Stanton. The source is a spring which supplies a population of 163 ; forty-eight houses are served by stand-pipes (six) ; eight properties have their own private wells. The present cost of maintenance is approximately £2 per annum, which is rate-borne.

Pattishall. *Population* (1931), 804. *No. of houses*, 231.

This parish consists of four hamlets—Astcote, Eastcote, Dalscote and Pattishall, and the eastern side of Foster's Booth.

In 1895 the Astcote Parish Council wrote to the District Council calling attention to the impurity of the water supply of that village, but their representative stated that the parish did not want a public water supply. After a discussion lasting several years, the scheme for a public supply was finally dropped. The present position is as follows :—

ASTCOTE.

There is one public well serving thirty-eight houses (132 persons) ; it is fitted with a hand pump ; no shortage has been reported. Eleven private wells supply 86 people (ten hand pumps ; one dip-well). Supplies have been short during the drought, but none has actually given out.

EASTCOTE.

One public well supplies thirty-three houses (114 persons) ; it is fitted with a hand pump, and yields sufficient quantity. There are fifteen private wells serving 103 people (fourteen hand pumps ; one dip-well). Several of the wells have failed during the dry season, and water is obtained from the public pump.

DALSCOTE.

Dalscote has no public supplies. There are five private wells fitted with hand pumps which appear to give reasonably good service.

FOSTER'S BOOTH.

Foster's Booth is also dependent on private wells—eight in number ; there has been no serious shortage.

PATTISHALL.

Pattishall has two public wells, one serving six and the other twenty premises ; both are fitted with hand pumps. There are twenty private wells (156 people) ; sixteen hand pumps ; three dip-wells and one spring. One dip-well, 152 feet, has been sunk at a private house ; the average depth of the wells in the village is only about 9 to 10 feet.

All the supplies have shown signs of failure during the drought, and three wells have dried up entirely.

The Women's Institute reports are given in full, as follows :—

PATTISHALL.

Pattishall has many rather shallow wells sunk to tap the many underground little streams which flow from the high ground to the west of the village. In many cases they are not more than 8 or 10 feet deep. The chief stream is so near the surface that stone or iron troughs have been built through which the water flows and is bailed out in buckets or jugs. Many other streams are a little deeper, but of much less force, and these soon fail in a dry period, in which case the people go to the village pump, which is a considerable distance in some cases The houses east of the church are badly off for water, as the supplies soon fail, as they are fed chiefly from surface water, but at one—Kirkholm—a well 152 feet deep has been sunk recently, and has tapped a strong supply, quite different from all the others, as it is impregnated with lime, all the others containing iron. There is a very strong spring which feeds the pond to the north-west of the village.

ASTCOTE.

Astcote has one very good pump in the centre of the village, and several others of an inferior quality, some of which very soon run dry in a drought. In that case the householders have some distance to carry their water. Many, by preference, fetch from the village pump for drinking and tea-making.

EASTCOTE.

Eastcote has a large number of shallow wells, many of which soon fail in a season which is at all dry. The village pump is excellent in every respect, but is a long way (well over fifty yards) from many of the houses that use it. Many with ample supplies fetch for drinking purpose by preference. The private supply pumped up by the hydraulic ram, was used to supply the German Internment Camp of about 1,000 people during 1914-15, and when supplemented with water from a spring near Astcote, and pumped by engine, was ample for the Prisoners of War Camp of about 4,000 men, from 1915 to 1919. The pipes of the second supply have been removed, as also the engine, etc. Most of the wells have dried up three times during 1933, the largest number failing in December.

FOSTER'S BOOTH.

Foster's Booth has several wells which derive their water from small underground streams from which the water is raised by pumps. There are two wells in general use, both properly covered and not very deep. There is a strong spring to the south-east of the village which supplies the pond marked on plan. Formerly there was a well with a pump to raise the water, but this has been done away with, and the well filled in. The other pumps in the village go dry only after a prolonged drought.

Plumpton. *Population* (1931), 32. *No. of houses*, 6.

Plumpton has one public well supplying four households (seventeen people) ; it is fitted with a hand pump and gives a moderate supply. There are two private wells serving ten people. The supplies have been poor during the year, but there has been no actual famine.

Shutlanger. *Population* (1931), 305. *No. of houses*, 79.

There are three public wells for this village. No. 1 serves seventeen families (84 people) ; the water from this well has been rationed during the summer. No. 2 serves twenty-six houses (91 people). No. 3 serves thirteen houses (46 people). Five families fetch their water from the brook. These wells are fitted with pumps, and the water, although barely sufficient in quantity, appears to be clear and not very hard.

There are eight private wells supplying 49 people in all, four hand pumps, one draw-well and four dip-springs. The supplies have shown signs of weakening during the year, but none has actually given out. Tests and gauging are in progress for a piped supply to the upper end of the village.

Silverstone. *Population* (1931), 803. *No. of houses*, 229.

The parish is situated on the great oolite overlying Northampton sand, and the upper lias clay is exposed in the valleys. The wells generally are shallow and liable to pollution. The six wells for public use are :—

(1) *Cattle End Pump*	51 households ;	140 people.
(2) *Puddle-Dock Pump*	27 ,,	83 ,,
(3) *Stock's Hill Pump*	30 ,,	138 ,,
(4) *Chapel Hill Pump*	45 ,,	114 ,,
(5) *Little London Pump*	8 ,,	23 ,,
(6) *Blackwell Spring*	17 ,,	53 ,,

In an average year, when the private supplies have not failed, the public wells are used to a considerably less extent. No. 5 pump has been closed for drinking purposes, and Nos. 2, 3 and 4 were rationed in February and March, 1934. There are also forty-five private wells supplying 266 people in all ; thirty hand pumps, eleven draw-wells, four dip-wells. Five supplies usually fail in summer, and nearly all have been weakened during the drought, and thirty-five per cent. have given out entirely. There are many good springs in the locality, and a scheme has been prepared by the consulting engineers to provide a piped supply for the whole village. A large spring in the valley east of Charlock Farm, about a quarter-of-a-mile north of the village, was investigated, and the yield in August, 1934, was found to be over 30,000 gallons a day. The scheme consists of : (*a*) the construction of a collecting tank and pumping station beside the spring ; (*b*) a pumping main to a point near the old windmill on the Whittlebury Road ; (*c*) an elevated tank at that point ; (*d*) distribution mains from there to the village. The estimated cost of the work to supply Silverstone is £4,500 ; loan charges would be £245 per annum, and the cost of maintenance from £75 to £100 ; this scheme is now under consideration.

Slapton. *Population* (1931), 101. *No. of houses*, 29.

The village of Slapton is dependent for its supplies on a few shallow wells.

Stoke Bruerne. *Population* (1931), 284. *No. of houses*, 81.

For many years Stoke Bruerne had two small supplies, one at the higher level from a spring, and the other at a low level supplied by a well. These were provided by the Duke of Grafton and Mr. Wentworth Vernon, and handed over to the Parish Council. In the dry summer, 1911, there was a serious shortage of water, and a councillor for the parish submitted plans and estimates for an improved supply for the lower level at an estimated cost of £80. In 1914, the Local Government Board gave sanction to a loan of £115 to carry out the scheme.

The present undertaking, if one may call it so, is owned by the Towcester Rural District Council, and consists of two supplies, as stated above, both of which have failed. Water from the upper part of the village is pumped from a spring on the canal bank to a storage tank. The lower part of the village obtains water from stand-pipes at the upper end, or from a pump at the Rookery Farm. The lower well is shallow, deriving its water from limestone. The upper reservoir, which is of brick, holds about 400 gallons, and the lower, also of brick, has a capacity of 1,000 gallons. The normal supply is by gravitation to serve 176 persons ; eight families are dependent on their own wells. Sixty-one households are supplied from seven stand-pipes, and no pipes are laid on to individual houses. There is an urgent need for a proper supply to this village. The present costs are as follows :—

Outstanding loan	£53 17s. 4d.
Maintenance costs	£33 0 0 per annum.

No water charge is made, and the whole expenditure is rate-borne.

Tiffield. *Population* (1931), 263. *No. of houses*, 43.

The village has one public supply to serve twenty households (fifty-five persons) ; it is fitted with a hand pump and gives a good supply of hard water. There are twelve private wells serving sixty persons, eleven fitted with hand pumps and one spring with a tap. The water is derived from the great oolite limestone.

The Surveyor notes that there are three good springs discharging into the stream which runs through the village, and it would be possible to obtain an auxiliary supply by this means.

Towcester. *Population* (1931), 2,252. *No. of houses*, 596.

Before the year 1901 Towcester was dependent for its water supply partly on various deep wells in the town, but largely on shallow wells from the drift gravels. These sources were not very satisfactory, and a public marlstone supply was introduced in 1901. A boring 355 feet deep, made in 1899 south-west of the town, penetrated the upper lias clay, but failed to give an adequate supply from the middle lias. This was abandoned, and a new boring in 1901, in field No. 365, close to the station, tapped an abundant marlstone supply at 102 feet. The water rose 7 feet above the surface at a rate of 1,200 gallons per hour. The cost of the borehole and trial pumping was £1,520. The water at first caused considerable trouble owing to the high figure of ammonia and chlorides—common in marlstone supplies for this district, but this difficulty gradually disappeared with use. The scheme has been, on the whole, thoroughly satisfactory, and occasional shortages have always been corrected by minor repairs and improvements.

The details of the present supply are as follows :—

SOURCE.

A well 102 feet deep, deriving water from the marlstone, and some auxiliary springs ; ground level 285.53 O.D., diameter of borehole 10 inches, rest level 105 feet 9 inches, average yield in 24 hours, 60,000 gallons.

SERVICE.

Water is pumped to a brick reservoir at Dockle Mill on the south side of Towcester (Brackley Road) ; the elevation (top water level) is 332.94 O.D., and the capacity 50,000 gallons ; there is no filtration or other treatment.

DISTRIBUTION.

There are no supplies in bulk. A constant supply by gravitation from the reservoir, serves a population of 2,087 out of a total of 2,143. 545 premises are directly supplied ; eighteen rely on " Blackwell," a well-known spring of doubtful purity in the south-east of the town close to Watling Street, and two have their own wells. Eighty-eight properties are supplied by stand-pipes ; there are eleven stand-pipes and twenty-two hydrants.

COSTS AND MAINTENANCE.

The total amount borrowed on the water scheme is divided into four loans of £2,200, £200, £1,400 and £300. The present annual amount of repayment, principal and interest, is £28 13s. 4d.; only No. 4 loan is outstanding (£196). The receipts from water rates amount to £330 4s. 10d. The scheme is normally self-supporting, but a large expenditure of over £100 in 1933 for overhaul of the mains in High Street, caused an adverse balance during the current year.

WOOD BURCOTE.

This hamlet in Towcester parish has no public supplies ; there are eight private wells serving eleven houses (forty-four people) ; there are two hand pumps, three draw-wells and three dip-wells ; the supplies have fallen low during the year, but none has given out.

CALDECOTE.

This hamlet has one public well serving nineteen households (sixty-two people). The well is covered and fitted with a hand pump ; no shortage has been reported. There are also three private wells fitted with hand pumps. All the supplies have been adequate during the year.

Wappenham. *Population* (1931), 301. *No. of houses*, 94.

There are no piped supplies to this village ; one public spring serves fourteen households (48 people) by means of a spout in the wall on the Syresham Road. This water is apparently good and clean and has never been known to fail.

Thirty-two premises are dependent on private wells—twenty-four handpumps, seven draw-wells and one windmill at the end of the village. There are many good springs in the locality, but evidently the wells in the centre of the village have fallen off a good deal during the drought. The Women's Institute reports in fact that nearly all the private wells have failed. The following report also supplied by the Women's Institute is of special interest. :—

> " Wappenham has plenty of excellent water, but it is not easily available to the inhabitants.
>
> At the top end of the village is a deep well (marked " O ") with windmill, which supplies Mr. Vellacott's farm buildings and " Wappenham House." I am told there is sufficient water here to supply the whole village.
>
> At the bottom end of the village is " The Spout " which has never been known to fail. This is excellent drinking water ; it runs continually and overflows into a small brook—gallons of good water run to waste.
>
> Two fields away is another spring which is good drinking water. As it means scrambling down a steep bank to obtain the water no one troubles to use it and it all runs to waste.
>
> The fourth is a spring at the back of a private house, marked " J " on the map. The owner has remarked that enough water runs to waste from this spring to supply the whole of Wappenham.
>
> The centre of the village is badly supplied with wells. People on the Green having to go five minutes' walk to well " E " to obtain any—others on the Green have a right of way to " G."
>
> The wells in the centre of the village are all below the level of the Churchyard surrounding Church, which is not conducive to good water. A great many people from centre of village bring cans down to " Spout " for drinking water, and only use their wells for cleaning."

Weedon Lois. *Population* (1931), 296. *No. of houses*, 88.

(*Milthorpe, Weedon Lois, and Weston-by-Weedon*).

The only historical note in my possession is dated 1904, " a resolution was read from Weedon Lois Parish Council saying that the water supply of the village was both inadequate and impure ; they asked the District Council to provide a supply for the Parish immediately. Parish Council carried that resolution by three votes to two.

The chairman pointed out that that was a small majority for an expensive scheme—nothing was done in the matter."

Milthorpe.

Milthorpe has one public well which serves seven families (16 people). This is a draw-well which fails every summer, and gave out completely during the drought. When the public well fails the houses obtain their water from a wheel-pump belonging to All Souls College. There is one other private supply—a draw-well which is also liable to fail. The water from the wheel-pump appears to be of good quality.

Weedon Lois.

Weedon Lois has four supplies, all shallow.

No. 1, a dip-well supplies seven houses.

No. 2, a pump which serves five houses, has failed entirely during the drought, and one household now gets its water from No. 3 which is not fit for drinking.

No. 4, a pump, serves twelve houses and has a fairly good supply ; people resort to this well when the others give out.

There are ten private supplies (four hand-pumps, four draw-wells, a spring, and one motor pump which serves three houses). The supplies have all been weakened during the drought, but none has actually given out.

Weston-by-Weedon.

Weston-by-Weedon has two public supplies, the one a dip-well and the other a pump. Both of these are unfit for drinking and are not used except for washing. There are twenty private wells—seventeen hand-pumps and three draw-wells. The water supplies have not given out although they have been very low during 1933. The Surveyor of the District Council informs me that there are good springs in the locality ; one, a Mill south-east of Milthorpe called " Jan-luddle " ; another near Weston-by-Weedon with a good supply, and one in the meadow near the centre of the village of Weedon Lois ; the quality of this spring does not appear to be good.

Whittlebury. *Population* (1931), 318. *No. of houses*, 97.

There are no public sources of water. Forty-two private wells (forty hand pumps and two draw-wells) serve 224 people in all. Three wells have failed during 1933, but the remainder have held out fairly well. There are apparently no springs of any strength in the village, and it is desirable to introduce a public piped supply. It may be possible to include this village in a scheme for Silverstone.

Woodend. *Population* (1931), 204. *No. of houses*, 60.

There is one public well approximately 70 feet deep, which serves seventeen houses (seventy people) ; it is a draw-well and gives a fair supply of doubtful water. There are fifteen private supplies (ten hand pumps and five draw-wells) serving eighty-four people in all. The supplies have weakened during the year, but none has actually given out. There are no springs in the immediate locality which could be obtained to augment the present resources.

WELLINGBOROUGH RURAL DISTRICT.

Bozeat. *Population* (1931), 1,175. *No. of houses*, 336.

There is very little information about the depth of strata at Bozeat, but evidently there is a great mass of overlying boulder clay before the great oolite series is reached. The village wells are mostly shallow and grossly polluted. There is no scheme of public water supply for the village, although a number of springs appear to be available. Of the three public wells, one (the Town Well) supplies three standpipes and also has a large trough for cattle.

There are about eighty private wells, ranging in depth from twenty to thirty feet, probably none of them reaching any formed water-bearing stratum. Roughly a quarter of this number failed completely during the drought, and the village supply may be considered as bad, in quantity, quality, and method of distribution.

Earls Barton. *Population* (1931), 2,578. *No. of houses*, 730.

All the wells in the neighbourhood of Earls Barton derive their water from the Northampton Sand, and a number of springs from this source arise on the eastern side of the town. The first public water supply, installed in 1891 at a cost of £3,000, was obtained from an ironstone well 22 feet deep. The original yield of this well was nearly 100,000 gallons a day, but it rapidly declined to 5,000 and is to-day almost dry.

In 1898 a second scheme was adopted to supplement the original supply by utilizing the water from Debdale Spring, at an estimated cost of £1,000. About 30,000 gallons a day was originally obtained from this source, but this supply has fallen during the recent drought to 15,000. The loans for these schemes have been repaid.

In 1924 an arrangement was made with the Higham Ferrers and Rushden Water Board for an auxiliary supply from their mains—which pass through the town. Recently some 4,000 gallons a day were obtained from this supply in order to make up the deficiency from the two wells.

The water supply of Earls Barton was reasonably satisfactory for some years after the installation of the second source, but faults in the system of distribution became so obvious that in 1932 proposals were brought forward for an expenditure of £3,450 in improving the system. The object of the proposals was to improve the water pressure, especially in certain parts of the town. The lack of pressure was due to (*a*) low elevation of the service reservoir in relation to houses built at higher levels, (*b*) the small size of supply mains, causing excessive loss of head.

The scheme provided for the erection of an elevated steel tank of 50,000 gallons capacity, in place of the existing reservoir. Enlargement of the mains, and improved pumping apparatus completed the proposals.

The present water supply consists of two wells, one of which is in Doddington parish. The water is pumped to a brick underground reservoir of 50,000 gallons capacity. During the last twelve months a cast iron tower with a tank of 50,000 gallons has been constructed in order to obtain more head. The water is not filtered or otherwise treated ; it passes by gravitation from the reservoir and tank to serve a population of 2,578. There are a few stand-pipes in yards etc., but the supply is mostly laid on to the houses. Until 1934 there was no serious shortage as Earls Barton has been able to augment its supply from the mains of the Higham Ferrers and Rushden Water Board which run through the town. During the current year, however, the prospect of shortage became more serious ; in June the Water Manager reported that No 1 well was yielding only 2,500 gallons a day, and No. 2 well 1,500 gallons ; the total consumption was 21,000 gallons daily. At a meeting in July, 1934, it was decided to recommend an expenditure of £200 to £300 as an emergency measure to connect a pipeline from a well in Mr. Elderton's meadow to the No. 1 well which had become completely dry. By this time the supply from the two wells had fallen to 13,000 gallons, and with a daily consumption of 17,000 gallons a balance of 4,000 gallons a day had to be obtained from the Higham Ferrers and Rushden Water Board.

The water is very hard but otherwise satisfactory in quality.

MAINTENANCE.

The outstanding capital costs are represented by a recent loan of approximately £3,600. Maintenance averages £556 a year, and the water charges are estimated to bring in £602 in an average year ; at the present time owing to heavy charges there is a trifling deficit.

Easton Maudit. *Population* (1931), 129. *No. of houses*, 36.

There has been no serious shortage in the water supply of this village, though the farms have been without their ordinary supply for some time.

The village and farms are supplied by the Marquess of Northampton from a deep well in the parish. Water is laid on to about nine houses, and six standpipes are provided in the Road for remainder of cottages. A spring in the village, which was used in 1921, is still available. There are a few private wells but these are not in use.

Ecton. *Population* (1931), 447. *No. of houses*, 125.

The supply is normally obtained by gravitation from springs in agricultural land and is stored in an underground brick reservoir at highest point of village, capacity 15,000 gallons. Water is laid on to about eight houses and remainder of village is supplied by seven standpipes in Road.

There is a shortage at present, and, of about twenty-five wells in existence, several are now in use.

Three public wells serve for other than drinking purposes.

Great Doddington. *Population* (1931), 450. *No. of houses*, 124.

The supply is adequate in an average year, but at present, as in 1921, a shortage is being experienced.

There are five public pumps with an underground tank to each and a number of taps at different points supplied by gravitation from a spring. Of a number of private wells, a few are still being used.

An excellent spring near the village, owned by Mr. Lamb, is a convenient source for a piped supply.

Earls Barton obtains a portion of its supply from a well in this parish.

Great Harrowden. *Population* (1931), 130. *No. of houses*, 30.

There is no public supply. The Hall has a good well and storage accommodation and supplies seven cottages belonging to the Estate.

The remainder of the village is dependent on about nine private wells varying from 22 feet to 26 feet in depth ; these are adequate in average years, but in 1921 there was a shortage. The water in the wells is very low, but there is not a serious shortage at present. The quality of the water is poor.

Grendon. *Population* (1931), 414. *No. of houses*, 118.

The question of a water supply for this village has been discussed for the last quarter of a century. A scheme was proposed in 1929 and was modified by the Ministry of Health ; the Rural District Council did not proceed with it on account of the cost (£3,280).

There is one public pump which has only a small quantity of water. A number of private wells exist, and one of these forms the chief source of supply for drinking purposes. The supply has been inadequate for some time, and all the wells in the village have been condemned.

A new scheme was approved by the Rural District Council and submitted to the Ministry of Health in June, 1934. This scheme is estimated to cost about £3,000, and is being proceeded with. It is proposed to obtain the supply from Hollowell Springs (two springs), which gave a yield at one time of 29,000 gallons per day, and at another time 40,000 gallons per day. In June, 1934, the measurement was 23,000 gallons per day. These springs are of the fluctuating type known throughout the County.

The scheme provides for the joining of the two springs by pipe and leading the water to a collecting tank near the main road (at Easton Washbrook Bridge) in a spinney belonging to Lord Northampton. This tank will have a capacity of 10,000 gallons. Owing to the elevation of Grendon, it will be necessary to pump from this tank to an elevated tank (12,000 gallons capacity) in a wood to the south of the Grendon Vicarage. The pipes between collecting and storage tanks are to be covered with asbestos and mains will be put in all over the village. Two stand-pipes will be erected, and, if people do not join up their property with the supply, a further stand-pipe will be put at the lower end of the village. The Marquess of Northampton is giving the water at a nominal charge of £1 per year, on condition that a free supply shall be given to the Manor Farm and three cottages.

Hardwick. *Population* (1931), 121. *No. of houses*, 28.

The Wellingborough Urban District Council obtains part of its supply from this parish and grants a free supply for the use of the village.

The water is pumped into a tank supplied by the Wellingborough Urban District Council and is sufficient and satisfactory. It is partly piped to houses and there are some stand-pipes.

Irchester. *Population* (1931), 2,503. *No. of houses*, 650.

Sanction by the Rural District Council was given to the Parish Council in 1901 to expend £25 in the sinking of a well to supply a portion of the village that was short of water. From 1904—1906 samples of the water from wells in the village showed them to be polluted. Negotiations took place in August, 1906, and continued to April, 1911, between the Wellingborough Rural District Council and the Higham Ferrers and Rushden Joint Water Board with a view to the latter body serving the parish of Irchester and an agreement was eventually signed. The Ministry of Health in May, 1912, sanctioned the raising of a loan of £4,000 for the laying of mains from Rushden and this work was carried out. In 1914, a shortage was experienced in Little Irchester, several of the wells giving out, and houses not up to then taking a supply from Rushden joined up with that source. In 1929, complaint was made that the higher part of the village was not obtaining sufficient pressure and a scheme was prepared and was the subject of a Ministry of Health Inquiry in June, 1930. This scheme comprised a reinforced concrete water tower of 100,000 gallons capacity, on a site about half a mile south of Irchester village, at the nearest available point to the Rushden and Higham Ferrers Board's rising main. The tower was to be 54 feet in height with the top water line about 50 feet above ground level. Provision was made for the Board's rising main, 11 inches in diameter to be tapped where it crossed the highway 583 yards from the tower. The amount of the loan was £3,464, and the scheme was sanctioned. The water tower was completed in June, 1931, and excellent supplies were at once received by those residents affected by the new scheme. The water is sold to the Irchester Parish Council by the Higham Ferrers and Rushden Water Board, stored in the water tower, and distributed to the village by taps to houses and a few stand-pipes. No restrictions have been enforced but the water in the reservoir is very low during the present general drought.

Isham. *Population* (1931), 365. *No. of houses*, 98.

A scheme was drawn up and sanction given by the Local Government Board to a loan of £2,535 for Waterworks for this parish, in 1908. Owing, however, to difficulties with the Ecclesiastical Commissioners over a lease of land upon which it was proposed to sink a well and erect a pumping station, the works were not completed until early in the year 1911. The scheme consists of a well 36 feet deep, 6 feet diameter, bricked, and has an average yield in normal times of 1,000 gallons per hour. There is a 30,000 gallon iron tank directly over well 75 feet high ;

a 4-inch main to village 1¼ miles and a 3-inch main in village total length 2¼ miles. The system is by gravitation. The Rectory and Rectory Farm are supplied free. There has been no complaint as to quality, but, as regards quantity, in February of this year the yield was falling fast. Practically the whole of the houses are connected, but there are a few standpipes in yards, etc. A scheme for augmenting the supply is in preparation.

Little Harrowden. *Population* (1931), 698. *No. of houses*, 190.

No public supply. There are about fifty private wells with an average depth of 20 feet. The water is of poor quality. The supply in normal years is adequate, but in 1921 was very short ; it is now deficient. There are no connections or stand-pipes and only a few pumps. The Wellingborough Urban District Council have agreed to supply this parish from Orlingbury and a scheme is to be prepared.

Mears Ashby. *Population* (1931), 366. *No. of houses*, 112.

The only public supplies consist of one well provided a number of years ago by the Feoffee, and a spring running into a tank at the side of the road giving a fair supply of water.

There are fifty-eight private wells, with an average depth of 12 feet to 18 feet. No stand-pipes, or connections to houses, pumps being used. The supply is normally sufficient, but three wells have failed in the years 1933 and 1934. The " Hall " gets its water from the Higham Ferrers and Rushden Water Board.

Newton Bromshold. *Population* (1931), 71. *No. of houses*, 18.

This small parish is served by a deep well given by a private owner. Two stand-pipes are provided ; no connection to houses. There is no shortage.

Orlingbury. *Population* (1931), 305. *No. of houses*, 72.

There is one public well on the Green, which is now practically dry. Also about twelve private shallow wells ; the water is very hard but fairly good. The supply is adequate during average years, but there was shortage in 1921 ; 75% of the wells are now dry and there is very little water in the remainder. There are no connections or stand-pipes ; pumps in the majority of cases.

The Wellingborough Urban District Council have agreed to supply this parish with water from their Orlingbury source.

Sywell. *Population* (1931), 185. *No. of houses*, 54.

Two public wells, but these are not in use. In the old part of the village there are about twelve wells with an average depth of 30 feet, and on the new estate known as " Overstone Heights " about thirteen wells ranging from 20 to 25 feet in depth. Pumps are used. The quality of the water is said to be satisfactory. The supply is adequate in the village, but there is a serious shortage at " Overstone Heights."

Wilby. *Population* (1931), 394. *No. of houses*, 111.

The question of the provision of a supply of water for this parish had been discussed by the Wellingborough Rural District Council and the Wilby Parish Council for some years prior to 1900, and in the latter year consideration was given to suggestions as to a supply being obtained from one of the following Authorities :—Wellingborough Urban District Council ; Northampton Town Council ; the then Higham Ferrers Water Company ; no arrangement was, however, come to with any of these bodies, and a scheme was prepared for the Parish Council in 1901 and approved by the Rural District Council, to enable the parish to obtain its own supply. Sanction was eventually given by the Local Government Board to a loan of £1,395 for the carrying out of this scheme, the particulars of which are as follows :—

An ample supply of water had been found where probably the old Fairy Glen Spring existed, on ground at the back of the brickyard at the Wellingborough end of the village, and upon this site a well was sunk to the depth of 55 feet. The pumping power was supplied by a windmill 16 feet high and the water pumped to a reservoir holding 20,000 gallons, erected on the Mears Ashby Road above the Rectory. Water was supplied to the village from the reservoir by one pipe, and five stand-pipes erected in different parts of the village for the use of the public. The windmill, 600 yards away from the reservoir, was supplied with a self-stopping automatic apparatus so that when the reservoir was full the pumping automatically stopped. The works were completed and the formal opening took place in April, 1902. Before the beginning of October of the same year, however, the scheme had failed and the village was practically without water. In December, 1902, a report from Mr. Beeby Thompson was received by the Rural District Council, as follows :—

"In accordance with my promise, I beg to submit to you a preliminary report on the water supply of Wilby as the result of my visit on Saturday last, November 22nd, which visit, I may say, was rather full of surprises. (1) I found that the Northampton sand spring, which I recommended should be utilised as a source of water, was running about as strongly as when I last tested it on October 25th, 1898, so that there can be no question of pumping at another place having cut off the supply. (2) The well which was made does not, and never did, intercept the Northampton sand water which I proposed should be used and the Local Government Board sanctioned. (3) The only source of water to the present well is that from the great oolite limestone, which was never regarded by myself as adequate for the supply of the village. (4) Unfortunately, even this great oolite spring has been largely squandered through being let down into another porous bed from which it can easily run away. That is to say, when the water rises eight feet in the well, the surplus runs away into the Northampton sand, and this might easily be two days out of three with a windmill service—a matter of small importance when supplies are good, but a serious one when they are low. (5) When it was found that the Northampton sand itself yielded no water, although capable of taking it, periodical failure was assured, and the well should have been abandoned. (6) The whole of the present difficulty arises from the fact that the site I selected for a well, as the result of a careful geological examination of the neighbourhood, was set on one side in deference to the opinion of a water diviner. As to the future, nothing can be done with the present well ; it must be abandoned, and a new one made sufficiently near to the freely running spring in the brickyard as to make the catching of it reasonably sure, and at the same time at a sufficient depth below the surface of the ground to ensure freedom from contamination, and I would suggest 15 feet as the least amount of covering permissible. The new works involved would be as below : The making of a new well of much less depth than the present one, but with greater storage capacity ; transferring the windmill to the new site ; lengthening the rising main. All of these works ought perhaps to be done for less than £200, but since it is uncertain what additional work might be required to make quite sure of tapping the whole of the spring, I think that a sum of £250 should be asked for. I would ask the Council to allow me to have sole control of the making of this new well ; and I shall be pleased to carry out the other necessary work involved."

In January, 1903, the Local Government Board deferred an application of the Rural District Council for sanction to a loan of £940 for the purposes of sewering the parish on it being found that a further outlay of £250 would be necessary to perfect the water supply. It was then explained that the new proposal was to sink another well—to reach a spring the existence of which was undoubted—on land adjoining that on which the well in 1901 was sunk It was suggested that the water should be raised by means of power from a new windmill, or, alternatively, that the present windmill be utilised to pump the water from both wells. An amended application was made in February, 1905, it being found necessary to increase the sum to be borrowed to £400, the Local Government Board requiring the erection of a suitable and durable engine house. Sanction to a loan of £369 was given in June, 1905, the Local Government Board refusing to consent to the taking down of the windmill and its erection on a new site. The work was completed early in 1906, and an oil engine was erected to work supplementary to the wind engine.

In April, 1907, a favourable report on the supply was given, and it is stated to have been adequate since until the general drought towards the end of 1933. Water in well is now very low, and pumping has to be done twice a day at the present time ; in ordinary circumstances once a day is sufficient. The system is by gravitation, and the majority of houses are connected. There are five stand-pipes.

Wollaston. *Population* (1931), 2,345. *No. of houses*, 602.

In September, 1900, the question of providing a water supply for this parish was before a Parish Meeting, and it was decided not to proceed in the matter. In November, 1901, the Parish Council considered the Higham Ferrers and Rushden Water Bill, in which the mains in connection with their scheme would pass through Wollaston. In November, 1906, the Parish Council considered a rough plan of a scheme including the provision of a joint water reservoir or tower for the parishes of Wollaston and Irchester, to be carried out at an approximate cost of £2,550, and the question was adjourned pending negotiations with the Higham Ferrers and Rushden Water Board. Two schemes were before the Parish Council in November, 1908, one for a joint scheme for the parishes of Wollaston and Irchester, and the other for acquiring water from the Higham Ferrers and Rushden Water Board. The latter scheme was approved by the Parish Council in December, 1908, subject to the Irchester Council being joint purchasers of the water. Negotiations were carried on between the Irchester and Wollaston Parish Councils, the Wellingborough Rural District Council, and the Higham Ferrers and Rushden Water Board, until February, 1911, when both Parish Councils decided to have separate schemes. In April, 1911, the Rural District Council entered into an agreement with the Higham Ferrers and Rushden Water Board for the supply of water in bulk to Wollaston. A loan of £4,000 was sanctioned by the Local Government Board for carrying out the necessary works, including a rood of ground, pipes, tower and tank. The Water Board's charges would be 9d. per 1,000 gallons for thirty years, subject to reduction in a certain event. The scheme was completed early in 1913, and connections with properties were then proceeding. In January, 1920, the County Medical Officer of Health, following an inspection of the parish, urged the necessity of laying on the public supply to properties. The water is brought from Sywell and stored in the Wollaston Water Tower, and is supplied to the village by private taps, etc.

The supply has been adequate and good in quality, but the water in Sywell reservoir is now very low.

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